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THE PHILIPPINE JOURNAL OF SCIENCE

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LITTORAL HOLOTHURIANS FROM ZAMBOANGA AND VICINITY

BY JOSE S. DOMANTAY
Of the Bureau of Fisheries, Manila

INTRODUCTION

In the early part of the year 1949, when the writer left for Los Angeles, California, with a Travel Grant from the U. S. Educational Foundation in the Philippines under the Fulbright Act, a research fellowship at the Allan Hancock Foundation of the University of Southern California, and under official detail in the United States of America by the Philippine Government, he brought along with him several zoological materials from Zamboanga for scientific study. Among some of the materials were preserved and dried specimens of holothurians collected by the writer. Just before he returned to the Islands in August 1950, he went over the Zamboanga materials after a year and a half studying the tremendous number of holothurian materials in the collections of the Allan Hancock Foundation from the East and West Pacific and from the Atlantic waters around Florida. A few months after his arrival in Zamboanga, when relieved of his administrative work which occupied most of his time, he resumed the study of the local materials which he has been collecting from the marine biological ground of the station and other places. The following represent the few materials collected from Zamboanga and vicinity. Other materials that may be collected later from other places will be reported in another paper.

Order ASPIDOCHIROTA Grube, 1840

Family HOLOTHURIIDÆ Ludwig

Subfamily HOLOTHURIINÆ Ludwig

Genus HOLOTHURIA Linnæus, 1758

1. *Holothuria argus* (Jaeger)
2. *H. atra* Jaeger
3. *H. bivittata* Mitsukuri
4. *H. curiosa* Ludwig
5. *H. impatiens* (Forskål)
6. *H. marmorata* Jaeger
7. *H. paradoxa* Selenka
8. *H. pulla* Selenka
9. *H. scabra* Jaeger
10. *H. sæcularis* Bell
11. *H. sæcularis* Bell var. *forskåli* n. var.
12. *H. vitiensis* Semper

Genus ACTINOPYGA Bronn

13. *Actinopyga echinites* (Jaeger)
14. *A miliaris* (Quoy and Gaimard)
15. *A serratidens* Pearson

Genus MICROTHELE Brandt, 1835

15. *Microthele nobilis* (Selenka)

Family STICHOPIDÆ, 1835

Genus STICHOPUS Brandt, 1835

16. *Stichopus variegatus* Semper
17. *S. variegatus* Semper var. *hermanni* Semper
18. *S. horrens* Selenka

Genus THELENOTA Brandt, 1835

19. *Thelenota ananas* (Jaeger)

Order APODA Brandt, 1835

Family SYNAPTIDÆ Ostergren, 1905

Genus SYNAPTA Eschscohltz, 1829

20. *Synapta maculata* (Chamisso and Eysenhardt)

Genus OPHEODESOMA Fisher, 1907

21. *Opheodesoma spectabilis* Fisher var. *puerto-galeræ* Domantay

Genus POLYPLECTANA H. L. Clark, 1907

22. *Polylectana kefersteinii* (Selenka)

HOLOTHURIA ARGUS (Jaeger)

Bohadschia argus JAEGER (1833) 19, *pl. 2, fig. 1*; SELENKA (1867) 320; BELL (1886) 27; PEARSON (1914a) 170.

Holothuria argus SEMPER (1868) 80, 277, *pl. 30, fig. 11*; LUDWIG (1882) 135; (1883) 168; (1889–92) 329; LAMPERT (1885) 87; (1889) 808; THEEL (1886a) 203; BELL (1887c) 653; (1888) 389; SAVILLE-KENT (1893) 56, 237, *pl. 34, fig. 2*; Colored *pl. 12, fig. 7*; STUDER (1893) 234, 248; KOEHLER (1895c) 279; WHITELEGGE (1897) 161; Sluiter (1901) 12; KONINGSBERGER (1904) 45; MITSUKURI (1912) 60, *pl. 3, fig. 30, text-fig. 13*; PEARSON (1913) 56, *pl. 7, fig. 5;* H. L. CLARK (1921) 174; PANNING (1929) 121, *text-fig. 2;* DOMANTAY (1933) 60, *pl. 1, fig. 2.*

Holothuria leopardus SAVILLE-KENT (1890), *pl. 1, fig. 2.*

All dried form made into *trepang* or *beche-de-mer*. Large size. The characteristic color pattern in life is still very evident in the dried form. In life the color is lilac with oval and round golden-brown blotches somewhat arranged in irregular series or rows resembling those of a leopard. Ventral side lighter in color and without golden brown blotches. Mouth ventral and anus terminal. Numerous and crowded pedicels in trivium and papillæ irregularly scattered in bivium.

Deposits.—Numerous dichotomous X-shaped bodies forming simple to complete rosettes, few wrench-like supporting rods of various sizes.

Remarks.—Found all over the Philippine Archipelago. The biggest so far encountered measured 450 mm long and 80 mm diameter. Usually found in sandy bottom among corals. One with Acc. No. 1204 is in the collection of the Allan Hancock Foundation.

Specimens examined:

Acc. No.	Locality	Date	Quantity
100–Z	Zamboanga waters	6–4–51	1

HOLOTHURIA ATRA Jaeger

Holothuria radackensis CHAMISSO and EYSENHARDT (1821) 352, *pl. 28.*

Holothuria amboinensis SEMPER (1868) 92, 279.

Holothuria atra JAEGER var. *amboinensis* THEEL (1886a) 214; BEDFORD (1898) 839; (1899) 147.

Holothuria sanguinolenta BELL (1893); DOMANTAY (1933) 73, *pl. 3, fig. 3.*

Holothuria atra JAEGER (1833) 22; SELENKA (1867) 327, *pl. 18, figs. 52–53;* (1868) 250; SEMPER (1868) 88, 250, 278, *pl. 26;* (1869) 120; LUDWIG (1881) 596; (1882) 137; (1883) 170; (1887b) 32; (1887d) 1217; 1887e) 1244; (1899) 559; BELL (1884) 510; (1886) 28; (1887a) 140; (1887c) 654, 657; (1888) 389; LAMPERT (1885) 84; (1896) 55; THEEL (1886a) 181, 213, *pl. 7, fig. 4*; SLUITER (1887) 188; (1894) 103; (1889–92) 329, *pl. 3, fig. 30, pl. 6, fig. 6*; (1895) 78; SAVILLE-KENT (1893) 49, 55, 102, 121, 234, 238, *pl. 33b*; STUDER (1893) 191, 234; KOEHLER (1895a) 382; WHITELEGGE (1897) 161; (1903) 8, 13; HEDLEY (1899) 530; H. L. CLARK (1901a) 495; (1902b) 530; (1920) 148; (1921) 174; (1923) 421; (1925) 102;

(1932) 231; VOLTZKOW (1902) 565; KONINGSBERGER (1904) 47, *pl. 8, fig. 2*; GARDINER (1904) 339; EDWARDS (1905) 383; (1908a) 537–540; (1908b) 236–301, *pls. 1–5*; HERDMAN (1906) 447; FISHER (1907) 657, *pl. 70, fig. 2*; KOEHLER and VANEY (1908) 5; (1910) 101; PEARSON (1910a) 176; (1913) 67, *pl. 9, fig. 11*; MITSUKURI (1912) 64, *text-fig. 14*; ERWE (1913) 374, *pl. 6, fig. 14*; BROOKE (1927) 164; PANNING (1928a) 221; (1935) 30, *text-fig. 22*; T. A. STEPHENSON, et al (1931) 45, 50, 55; BAKER (1929a) 141–143; (1928b) 167–171; ENGEL (1933) 4, *pl. 1, fig. 1, text-figs. 1–6.*

Body cylindrical. Mouth and anus terminal. Twenty stout peltate tentacles. Pedicels and papillæ similar, apparently all pedicels scattered all over the body but most conspicuously and crowded at the ventral side. Body-wall tough and hardy. Color in life purplish black and usually exudes purplish fluid. In preserved state blackish all over the body.

Deposits.—Tables with small perforated disk, four pillars and two cross-beams. Spire terminates in spinous crown with usually 12 spines. Intermixed with the tables are few, sometimes numerous rosettes, some of which are incomplete. Pedicel with well developed end-plate.

Remarks.—Common all over the Islands. Found in sandy bottom among corals. In Puerto Galera Marine Biological Station they were usually found covered with fine sands on the dorsal side forming blotches of white and black. No Cuvierian organs. At the marine biological ground in Zamboanga, because of the strong current, the integument does not accumulate fine sands. The biggest so far encountered measured 500 mm long by 60 mm diameter.

Specimens examined:

Acc. No.	Locality	Date	Quantity
101–Za	Marine Biol. Ground, Zamboanga	6–2–51	2
101–Zb	Zamboanga waters	6–2–51	1

HOLOTHURIA BIVITTATA Mitsukuri

Holothuria bivittata MITSUKURI (1912) 68, *pl. 3, fig. 31, text-fig. 15.*
Holothuria (*Bohadschia*) *bivittata* PANNING (1929) 123, *text-fig. 4.*

All dried form made into *trepang* or *beche-de-mer.* The biggest among the four examined measured 150 mm long hence in life may be three times as long. Mouth apparently ventral and anus terminal. Body-wall thick and hardy. Both pedicels and papillæ retracted, the former apparently arranged in bands in the trivium and the latter scattered in the bivium. Color in the dried and preserved state on the dorsal side is purplish

brown intermixed with numerous irregular ramifying blotches of lighter brown apparently yellowish in life which gives a semi-variegated appearance. On the ventral side the color is more homogenous, lighter almost white. At both ends particularly in the anal end the same color extends over the dorsal side forming a broad band around it.

Deposits.—Numerous minute bodies from simple granular form to complete rosette. Intermediate forms are regular X-shaped rosettes. The complex rosettes predominate on the dorsal integument.

Specimens examined:

Acc. No.	Locality	Date	Quantity
102–Za	Zamboanga waters	6–6–51	1
102–Zb	Zamboanga waters	6–7–51	2

HOLOTHURIA CURIOSA Ludwig

Holothuria fusco-cinerea JAEGER (1838); SEMPER (1868) 88, *pl. 27, 30, fig. 22*; LUDWIG (1882) 137; (1887d) 1227; THEEL (1886a) 221; LUDWIG and BARTHELS (1892) 632; SAVILLE-KENT (1893) 233, 237; H. L. CLARK (1921) 177; (1932) 231; DOMANTAY (1933) 71, *pl. 4, fig. 1*; MORTENSEN (1934) 6.

Holothuria curiosa LUDWIG (1875) 34, *pl. 7, fig. 29*; LAMPERT (1885) 64; THEEL (1886a) 181, 220, *pl. 8, fig. 9*; SLUITER (1901) 10; PEARSON (1910a) 177; (1913) 75–76.

Holothuria (Holothuria) curiosa PANNING (1935) 4–5, *text-fig. 107.*

Body cylindrical and partly contracted. Mouth slightly ventral and anus terminal. Pedicels and papillæ partly contracted with their tips only exposed, the former somewhat arranged in indistinct rows and so with the latter. The papillæ apparently in the form of warts, hence very conspicuous and others indistinct when contracted. Color in preserved state greenish brown on the dorsal side with the tips of the papillæ very conspicuous appearing like dark spots. In life when not contracted the dark transverse bands are prominent. Ventral side grayish white dotted with the tips of the pedicels. Apparently medium size measuring 50 mm long by 25 mm diameter in its partly contracted condition.

Deposits.—Simple tables and imperfect buttons. Table with simple disk. Spire with four pillars converging distally and in some, united together beyond the crossbeam forming a cone. Imperfect buttons with a pair of elongated holes and in some with extra pairs of small holes. Pedicels with supporting plates in the form of huge irregular buttons.

Specimens examined:

Acc. No.	Locality	Date	Quantity
103–Z	Marine Biological Ground, Zamboanga	6–4–51	1

HOLOTHURIA IMPATIENS (Forskål)

Fistularia impatiens FORSKÅL (1775) 121–129, *pl. 39, fig. B.*
Holothuria aphanes LAMPERT (1885) 242; OSTERGREN (1898) 233; SLUITER (1901) 16.
Holothuria fulva QUOY and GAIMARD (1833) 135.
Holothuria botellus SELENKA (1867) 335, *pl. 19, figs. 82–84*; (1868) 117; SEMPER (1868) 82, 248; SAVILLE-KENT (1893) 234, 238.
Holothuria impatiens SALENKA (1867) 340; SEMPER (1868) 82, 277; (1869) 120; GRAY (1872) 123; v. MARENZELLER (1874) 320; LUDWIG (1879) 569; (1880) 6; (1882) 126; (1883) 169; (1887c) 31; (1887d) 1226; (1888) 806; (1889–92) 329; (1899) 558; HAACKE (1880) 46; BELL (1894c) 510; (1887a) 510; (1887b) 140; (1887c) 654; (1888) 389; LAMPERT (1885) 65; (1889) 812; (1896) 54; (1889) 312; THEEL (1886) 7; SLUITER (1887) 47; (1895) 78; (1901) 9; HEROURD (1889) 677; (1893) 134; SAVILLE-KENT (1893) 233, 237; KOEHLER (1895b) 282; (1895c) 12, *fig. 11*; (1921) 173; *fig. 129*; (1927) 214, *pl. 16, fig. 19*; BORDAS (1898) 840; (1889a) 187–204; (1899) 16, *pl. 1*; BEDFORD (1898) 840; (1899) 145; OSTERGREN (1898) 233–237; RISSO (1899) 133–141; (1900) 38–41; H. L. CLARK (1902a) 258; (1902b) 528; (1920) 149; (1921) 178, *fig. 2*; (1923) 423; (1925) 103; (1926) 192; (1932) 232; KONINGSBERGER (1904) 51, *pl. 8, fig. 3*; FISHER (1907) 660, *pl. 69, fig. 4*; KOEHLER and VANEY (1908) 8; PEARSON (1910a) 178; (1910b) 192; (1913) 85, *pl. 13, fig. 21*; (1914) 171; MITSUKURI (1912) 80, *text-fig. 17*; ERWE (1913) 369; MORTENSEN (1926) 117; DEICHMANN (1926) *fig. 11*; (1930) 64, *pl. 3, figs. 17–18*; SCHMIDT (1929) 1365, 1391, *figs. 197–198*; (1930) 406–412; 419–423; 459, 483, *figs. 36–43, 52, 53, 64, 75, 85, 98*; T. A. STEPHENSON, et al. (1931) 55; DOMANTAY (1933) *pl. 2, fig. 4*; PANNING (1935) 86–88, *text-fig. 72.*

Body cylindrical, mouth and anus terminal. Medium size with small peltate tentacles. Pedicels scattered all over the body and distinctly papillated, the conical tips with warty bases. Integument rough to the touch and tough. Color in preserved state dark brown mottled with tiny spots. With dark blotches on dorsal side.

Deposits.—Numerous buttons and tables. Tables large with squarish disk and large holes. Spire somewhat massive with a crossbeam and spinous crown. Buttons smooth and regular with three pairs of holes and few with more pairs. Pedicels with end-plate and supporting rods, the latter with dilated central perforated shaft somewhat symmetrical and both ends with small perforations.

Remarks.—The specimen examined is with the collections of the Allan Hancock Foundation donated by the writer.

Acc. No.	Locality	Date	Quantity
1204–AHF	Zamboanga waters	1948	1

HOLOTHURIA MARMORATA (Jaeger)

Bohadschia marmorata JAEGER (1833) 18, *pl. 3, figs. 9–10*; SELENKA (1867) 339; PEARSON (1914a) 170.

Holothuria marmorata SELENKA (1868) 118; SEMPER (1868) 79, 227, *pl. 30, fig. 10, pl. 35, fig. 3, pl. 36, fig. 8, pl. 37, figs. 1–4*; LUDWIG (1881) 594; (1882) 135; (1883) 186; (1888) 806; (1889–92) 330; (1894) 7; LUDWIG and BARTHELS (1892) 632; LAMPERT (1885) 86; THEEL (1886a) 202; SLUITER (1887) 185; (1894) 103; (1895) 78; (1901) 12; BELL (1887c) 145; (1888) 385; SAVILLE-KENT (1893) 236; MITSUKURI (1896) 406; (1912) 106, *fig. 21*; PEARSON (1903) 202; (1910a) 179; (1913) 54, *pl. 7, fig. 4*; KONINGSBERGER (1904) 44; H. L. CLARK (1921) 180.

Holothuria (*Bohadschia*) *marmorata* PANNING (1929) 120–121, *text-fig. 1.*

Sporadipus (*Colpochirota*) *ualensis* BRANDT (1835) 146.

Holothuria ualensis SELENKA (1867) 341.

Holothuria brandti SELENKA (1867) 320.

Holothuria utrimquestigmosa HAACKE (1880) 48.

All dried form made into *trepang* or *beche-de-mer*. The biggest measured 140 mm long which apparently in life is three times as long. Mouth ventral and anus terminal. Body wall very thick and hardy. Pedicels and papillæ partly retracted, the former confined in the trivium and the latter scattered all over the bivium. Color in the dried and preserved state is chestnut-brown speckled with numerous tiny spots representing the tips of the papillæ on the dorsal side, lighter in color on the ventral side with brownish violet blotches speckled with purplish spots representing the tips of the pedicels.

Deposits.—Numerous rosettes from simple to complex forms, some of which appear like irregular perforated plate-like buttons. Simple granular bodies are found in the deeper integument.

Specimens examined:

Acc. No.	Locality	Date	Quantity
104–Z	Zamboanga waters	6–9–51	2

HOLOTHURIA PARADOXA Selenka

Holothuria paradoxa SELENKA (1867) 322, *pl. 18, fig. 41*; SEMPER (1868) 92; LAMPERT (1885) 87; THEEL (1886a) 206; FISHER (1907) 652, *pl. 67, figs. 4, 5, pl. 69, fig. 5.*

Holothuria (*Bohadschia*) *paradoxa* PANNING (1929) 123–124, *text-fig. 5.*

Bohadschia paradoxa PEARSON (1914a) 170.

Body subcylindrical. Mouth ventral and anus terminal with five groups of papillæ. With 20 light brown peltate tentacles. Pedicels and papillæ almost the same, apparently all pedicels scattered all over the body. Among pedicels on the dorsolateral sides are somewhat larger and prominent conical appendages which may be regarded as papillæ arranged in irregular rows. Body-wall thick and hardy. Color of dorsal side grayish brown in life and lighter brown in dried form with irregular darker area of different pattern. Ventral side lighter and homogenous, almost white. Medium size, the average in the present collection is 100 mm long by 30 mm diameter, slightly wider than its depth.

Deposits.—Numerous dichotomously branched tiny rods of various forms from simple granular to more complex rosettes, some stout smooth dumb-bell shaped rods, some monkey-wrench shaped rosettes to perfect mossaic. Pedicel with well developed end-plate and few small supporting rods racemose at both ends.

Specimens examined:

Acc. No.	Locality	Date	Quantity
105–Za	Marine Biological Ground, Zamboanga	6–4–51	3
105–Zb	Zamboanga waters	6–4–51	1

HOLOTHURIA PULLA Selenka

Holothuria pulla SELENKA (1867) 326, *pl. 18. fig. 51*; SEMPER (1868) 92, 279; BELL (1884c) 510; THEEL (1886a) 214; PEARSON (1913) 69; PANNING (1934) 34.

Microthele æthiops BRANDT (1835) 55.

Holothuria æthiops SELENKA (1867) 331; SEMPER (1868) 90, 250; LUDWIG (1881) 597; LAMPERT (1885) 84; THEEL (1886a) 214.

Holothuria atra DOMANTAY (1933) 61, *pl. 2, fig. 6.*

Body cylindrical and capable of considerable extension in life. Mouth and anus terminal. With 20 medium size tentacles. Pedicels and papillæ almost similar, apparently all pedicels scattered all over the body and much crowded on the ventral side. Body-wall soft and thin in life although it becomes thicker in contracted form. Color in life is dark chestnut-red, almost black at a distance. In preserved state the color becomes light brown because the dark purplish color is extracted even in formalin. In life it may resemble *Holothuria atra* Jaeger in appearance and color although it differs from the other in the presence of Cuvierian organs and the texture of its body wall. Usually large size, the biggest so far encountered measured 600 mm long although the average length is 300 mm.

Deposits.—Numerous tables and buttons. Short tables with simple to well developed disk, the simpler ones with four smaller

holes, one to each below the pillars while the well developed disk with numerous smaller holes all around the circular margin. Spire low with four pillars united by a cross-beam and terminate in a spinous crown with the spines directed outward. Buttons of two kinds, symmetrical and assymmetrical with respect to the pairs of elongated holes, the symmetrical ones with usually three pairs and the asymmetrical with more or less not usually in pair. Pedicels with regular end-plate and medium size supporting rods, some resemble huge button-like plates.

Remarks.—Couple of this species is with the collections of the Allan Hancock Foundation donated by the writer.

Acc. No.	Locality	Date	Quantity
106–Za	Marine Biological Ground, Zamboanga	6–2–51	1
106–Zb	Marine Biological Ground, Zamboanga	6–2–51	2
1204–AHF	Marine Biological Ground, Zamboanga	1948	2

HOLOTHURIA SCABRA Jaeger

Holothuria scabra JAEGER (1833) 23; SELENKA (1867) 341; (1868) 118; SEMPER (1868) 79, 247, 277; LUDWIG (1880) 6; (1881) 559; (1882) 135; (1883) 168; (1887b) 31; (1887d) 1224; (1887e) 1242; (1888) 807; (1889–92) 330; (1899) 557; HAACKE (1880) 46; LAMPERT (1885) 69; THEEL (1886a) 234; SLUITER (1887) 193; (1894) 103; (1895) 78; (1901) 11; LAMPERT (1896) 54; KONINGSBERGER (1904) 52; KOEHLER and VANEY (1908) 16; PEARSON (1910a) 180; (1910b) 193; (1913) 87, *pl. 13, fig. 22*; MITSUKURI (1912) 135, *text-fig. 24*; H. L. CLARK (1920) 150; (1921) 181; (1923) 424; (1932) 235; SCHMIDT (1930) 415; DOMANTAY (1933) 74, *pl. 2, fig. 3.*

Holothuria tigris SELENKA (1867) 333, *pl. 19, figs. 70–72.*

Holothuria cadelli BELL (1887) 144, *pl. 16, fig. 7.*

Holothuria gallensis PEARSON (1903) 203, *pl. 3, figs. 46–50.*

Body subcylindrical. Mouth ventral with 20 peltate tentacles. Anus terminal with five groups of papillæ around the rim. Minute papillæ apparently pedicels are irregularly scattered all over the body. Papillæ on the dorsal side are grayish encircled by lighter area. In life color varies from olive-green with a shade of white and few black incomplete bands on the dorsal side to almost homogenous grayish green. Ventral side usually whitish-gray with a shade of light yellow. Average size 160 mm long by 45 mm width by 30 mm depth.

Deposits.—Numerous knobbed buttons and low stout tables. Knobbed buttons with three pairs of holes and others with more, the middle ones elongated and large. Margin markedly indented. Disk of table with a large central hole and several smaller peripheral ones. Spire composed of four stout pillars

which terminate distally in a spinous crown. Spire with a cross-beam. Pedicels with small end-plate and supporting rods, the latter slightly spinous, perforated and expanded at middle and at both ends. Huge button-like fenestrated plates also found.

Remarks.—A specimen of this species is with the collection of the Allan Hancock Foundation donated by the writer. Common all over the Islands.

Specimens examined:

Acc. No.	Locality	Date	Quantity
1204–AHF	Marine Biological Ground, Zamboanga	1948	1
107–Z	Zamboanga waters	6–5–51	1

HOLOTHURIA SÆCULARIS Bell

Holothuria sæcularis BELL (1887b) 534, *pl. 45, fig. 6.*
Holothuria (Holothuria) sæcularis PANNING (1935) 12, *text-fig. 120.*

All dried form made into *trepang* or *beche-de-mer.* The biggest among the seven specimens examined is 180 mm long which apparently in life measures three times as long. Mouth slightly ventral and anus terminal. Body-wall very thick and hardy. Pedicels and papillæ the same, apparently—all pedicels scattered all over the body. Color in dried or in preserved state is dark brown on the dorsal side and much lighter ventrally. Tips of pedicels much darker and in the retracted condition appearing as spots over the bivium.

Deposits.—Only knobbed buttons, the majority with three pairs of holes. No table.

Specimens examined:

Acc. No.	Locality	Date	Quantity
108–Za	Zamboanga waters	6–5–51	4
108–Zb	Zamboanga waters	6–6–51	2
108–Zc	Zamboanga waters	6–7–51	1

HOLOTHURIA SÆCULARIS Bell var. FORSKÅLI n. var.

From a dried material made into *trepang* or *beche-de-mer.* Resembling the appearance of the straight species externally with lighter color in both dorsal and ventral sides. Mouth ventral and anus terminal. Body-wall thick and hardy.

Deposits.—Knobbed buttons characteristic of the straight species with some irregular perforated plate-like disc with from two to four large holes resembling those of *Holothuria forskåli* Deele Chiaje as illustrated by Panning (1935) 13, *text-fig 119.* The presence of the latter spicules cannot be due to contamination from other species because none of this

type of spicules has been encountered in any of the other species examined and studied. Hence tentatively considered a new variety.

Further study will be made when more materials will be available. It is expected that some more materials may be encountered later around this place and more detailed description may be given.

Specimen examined:

Acc. No.	Locality	Date	Quantity
109–Z	Zamboanga waters	6–6–51	1

HOLOTHURIA VITIENSIS Semper

Holothuria vitiensis SEMPER (1868) 80, 247, 277, *pl. 30, fig. 12*; LAMPERT (1885) 89; THEEL (1886a) 203; LUDWIG (1889–92) 330; SAVILLE-KENT (1893) 238; SLUITER (1895) 78; (1901) 13; KOEHLER (1895a) 382; PEARSON (1903) 201; (1913) 57, *pl. 7, fig. 6*; KONINGSBERGER (1904) 45; FISHER (1907) 653; MITSUKURI (1912) 146; DOMANTAY (1933) 76–77, *pl. 1, fig. 2.*

Bohadschia vitiensis PEARSON (1914a) 170.

Holothuria tenuissima SEMPER (1868) 85, 248, 277, *pl. 30, fig. 20*; LAMPERT (1885) 88; LUDWIG (1882) 136; THEEL (1886a) 204; SLUITER (1887) 185; (1901) 14; KOEHLER (1895a) 383; PEARSON (1903) 201; KOEHLER and VANEY (1908) 16.

Holothuria clemens LUDWIG (1875) 31, *pl. 7, fig. 49*; LAMPERT (1885) 88; THEEL (1886a) 204; MITSUKURI (1912) 149.

Holothuria similis SEMPER (1886) 85, 277, *pls. 25 and 30, fig. 18*; LAMPERT (1885) 88; THEEL (1886a) 204.

Holothuria kollikeri SEMPER (1868) 86, 277; *pl. 30, fig. 25, pl. 35, fig. 7;* LAMPERT (1885) 87; THEEL (1886a) 204; LUDWIG (1887c) 31; LUDWIG and BARTHELS (1892) 632.

Holothuria (Bohadschia) vitiensis PANNING (1929) 122, *text-fig. 3.*

Body stout cylindrical and blunt at both ends. Mouth slightly ventral and anus terminal. Mouth with 20 short peltate tentacles. Anus with five prominent papillæ. Numerous pedicels scattered all over body and when retracted the integument looks smooth. Color in life as well as in dried or preserved state is dark orange dorsally and much lighter ventrally dotted with numerous tiny darker spots representing the tips of the retracted pedicels. Big size measuring around 300 mm long by 100 mm diameter.

Deposits.—Numerous tiny rosettes ranging from simple X-shaped to perfect ones, some resembling the miliary granules of *Synapta maculata* (Chamisso and Eysenhardt). Tip of pedicel with regular end-plate. Pedicel with big rosettes some of which are dichotomous X-shaped bodies.

Remarks.—Common all over the Islands. With numerous thick Cuvierian organs. Body thick and tough.

Specimens examined:

Acc. No.	Locality	Date	Quantity
110–Z	Zamboanga waters	5–31–51	1

Genus ACTINOPYGA Bronn

ACTINOPYGA ECHINITES (Jaeger)

Mulleria echinites JAEGER (1833) 17, 18, *pl. 3, fig. 6*; SELENKA (1867) 312; SEMPER (1868) 76, 276, *pl. 30, fig. 8*; LUDWIG (1882) 134; (1887d) 1223; (1889–92) 329; (1899) 557; LAMPERT (1885) 99; (1896) 59; THEEL (1886a) 201; SLUITER (1894) 104; WHITELEGGE (1897) 160; (1903) 13; PEARSON (1910b) 191; ERWE (1913) 366, *pl. 6, fig. 11*; MITSUKURI (1912) 43.

Actinopyga echinites SAVILLE-KENT (1893) 236; BEDFORD (1898) 835–836; PEARSON (1914b) 183, *pl. 29, fig. 7*; DOMANTAY (1933) 53–54, *pl. 4, fig. 5.*

Holothuria (Actinopyga) echinites PANNING (1929) 129, *text-fig. 12.*

Body ovate and subcylindrical. Mouth ventral with 20 peltate tentacles. Anus terminal with five calcareous teeth. In some, anus slightly turned dorsad. Body-wall thick and tough. Papillæ very prominent and scattered all over the bivium. Few teat-like protuberances with papilla at tip arranged in two indistinct series on the dorsal side. Pedicels arranged in three bands inter-mixed with few ones in the interambulacral area in the trivium. Color in life grayish-brown to grayish-green with few indistinct darker blotches on the dorsal side and more homogenous lighter ventrally. In dried form the dorsal side is dark brown and grayish-white ventrally. Medium size, the biggest in the present collection is 120 mm long.

Deposits.—Numerous rods from simple slightly spinous to branching ones resembling some of the *Actinopyga mauritiana* (Quoy and Gaimard) and dichotomous X-shaped rosettes. Some of the rods have smooth shaft and racemose ends. Rods and rosettes of various sizes.

Specimens examined:

Acc. No.	Locality	Date	Quantity
111–Za	Marine Biological Ground, Zamboanga	6–1–51	2
111–Zb	Marine Biological Ground, Zamboanga	6–4–51	2

ACTINOPYGA MILIARIS (Quoy and Gaimard)

Holothuria miliaris QUOY and GAIMARD (1833) 137.

Mulleria miliaris BRANDT (1835) 74; SELENKA (1867) 314; (1868) 117; SEMPER (1868) 76, 276; LUDWIG (1880) 7; (1882) 134; (1883) 165; (1887a) 144; (1888) 812; (1889–92) 329; (1899) 557; HAACKE (1880) 46; LAMPERT (1885) 99; THEEL (1886a) 200; SLUITER (1894) 104; (1895) 79; (1901) 23; KOEHLER and VANEY (1908) 22; PEARSON (1910a) 175.

Holothuria lineolata QUOY and GAIMARD (1833) 137–138; BRANDT (1835) 74; SELENKA (1867) 314.
Mulleria plebeja SELENKA (1867) 312.
Actinopyga miliaris BELL (1887e) 653, *pl. 40, fig. 1*; (1888) 389; PEARSON (1914b) 181, *pl. 29, fig. 6*; DOMANTAY (1933) 53, *pl. 4, fig. 6.*

Body subcylindrical with bivium and trivium marked off distinctly. Mouth ventral with 20 short peltate tentacles. Anus terminal with five calcareous teeth. Body-wall thick and hardy. Papillæ scattered irregularly on bivium and pedicels somewhat arranged in three distinct bands on the trivium. Color in preserved state orange-brown usually with a large chestnut-brown blotch on the dorso-posterior part. Medium size.

Deposits.—Numerous minute rosettes which are dichotomously branched, X-shaped with dichotomous bifurcation and few spinous rods.

Remarks.—Five specimens in the collections of the Allan Hancock Foundation donated by the writer.

Specimens examined:

Acc. No.	Locality	Date	Quantity
12004–AHF	Zamboanga waters	1948	3

ACTINOPYGA SERRATIDENS Pearson

Actinopyga serratidens PEARSON (1903) 199, *pl. 3, figs. 26–41*; (1914b) 179, *pl. 29, fig. 5.*
Holothuria (*Actinopyga*) *serratidens* PANNING (1929) 126, *text-fig. 8.*

Body subcylindrical with the bivium and trivium well marked. Mouth ventral with 20 peltate tentacles. Anus terminal with five calcereous teeth. Body-wall thick and hardy. Papillæ scattered irregularly over the bivium and pedicels in three distinct bands on the trivium. Color in life as well as in preserved state dark purple almost black all over the body. Somewhat corrugated at the bivium in one specimen apparently due to contraction. In one eviscerated specimen with the body-wall relaxed the color is lighter and uniformly dark-brown.

Deposits.—Numerous rods dichotomously branched at both ends, some with racemose ends, few with dichotomous side branches from the middle of the shaft and at both ends giving the appearance of a perfect rosette. Spicules not so thickly found unlike the other species. Shapes of the spicules agree exactly with the illustrations given by Pearson.

Specimens examined:

Acc. No.	Locality	Date	Quantity
112–Z	Marine Biological Ground, Zamboanga	6–16–51	3

Genus MICROTHELE Brandt, 1835

MICROTHELE NOBILIS (Selenka)

Mulleria nobilis SELENKA (1867) 313, *pl. 17, figs. 13–15*; SEMPER (1868) 76, 276, *pl. 37, figs. 9–12*; (1869) 120; THEEL (1886) 198.
Actinopyga nobilis FISHER (1907) 647.
Holothuria maculata BRANDT (1835) 54; SELENKA (1867) 331; SEMPER (1868) 92, 279.
Mulleria maculata LUDWIG (1881) 593; (1889–92) 329; (1899) 557; LAMPERT (1885) 97; MITSUKURI (1912) 48, *pl. 3, figs. 23–24, text-fig. 10*; ERWE (1913) 368, *pl. 6, fig. 12.*
Actinopyga maculata BEDFORD (1899) 150.
Argiodia maculata PEARSON (1914a) 170; (1914b) 174, *pls. 27–28, fig. 2*; DOMANTAY (1933) 55–56, *pl. 1, fig. 1.*
Mulleria hadra SELENKA (1867) 313, *pl. 17, fig. 16*; LAMPERT (1885) 97; THEEL (1886a) 198.
Argiodia flavo-castanea PEARSON (1914b) 176, *pl. 28, fig. 3.*
Holothuria (Microthele) nobilis PANNING (1929) 131–132, *text-fig. 15.*

Body subcylindrical with the bivium and trivium well marked off and rounded at both ends, with five large conical protuberances along each ventro-lateral ambulacrum. Body-wall very thick and tough. Mouth ventral and anus terminal with five small calcareous teeth surrounded by groups of papillæ. Few papillæ sparsely scattered on the bivium and numerous pedicels arranged in three indistinct bands on the anterior trivium and crowded posteriorly. Color in life dark brownish-gray to almost black and much lighter ventrally. In dried or preserved state the color is lighter.

Deposits.—Few tables, hollow fenestrated ellipsoids and numerous knobbed buttons. Disk of table irregular with smooth undulated margin and a large central hole surrounded by several smaller ones. Spire short with stout pillars and terminate in a spinous tufty crown. With a cross-beam. The ellipsoids and knobbed buttons numerous. Pedicles with regular end-plate and supporting plates.

Remarks.—Most of the specimens examined were in dried form *trepang* taken from the Chinese dealers in Zamboanga. Six of the specimens are in the collections of the Allan Hancock Foundation donated by the writer. One of them is labelled *Argiodia maculata* (Brandt) var. *thelenotæ*, a new variety. The presence of the characteristic spicules of *Thelenota ananas* (Jaeger) mixed with that of *Argiodia maculata* (Brandt) found

in the integument of the latter confused the writer. Upon further study it was found that spicules of other species may contaminate others when placed together in the same container. The new variety mentioned above is therefore discarded. The two different species were placed together in one container for some time before they were examined and studied by the writer.

Specimens examined:

Acc. No.	Locality	Date	Quantity
1204–AHF	Zamboanga waters	1950	6
113–Z	Zamboanga waters	6–2–51	5

Family STICHOPIDÆ Brandt, 1835

Genus STICHOPUS Brandt, 1835

STICHOPUS VARIEGATUS Semper

Stichopus variegatus SEMPER (1868) 72; H. L. CLARK (1921); DOMANTAY (1933) 79–80, *pl. 2, fig. 1.*

Body quadrangular and elongated. Mouth ventral and anus terminal. With 20 peltate tentacles. Papillæ of two sizes on the bivium, those of the dorso- and ventro-lateral ambulacra large and prominent, and those of the interambulacral area small and oftentimes inconspicuous in contracted condition. Pedicels arranged in three distinct bands on trivium with the median band much wider than the laterals. Body-wall thick but not hardy, easily disintegrate even if just taken from the water when mechanically abraded. Color in life olive-gray with different shades of green and yellow and fine black transverse striations running irregularly over the bivium. The ground color appears variegated with the dark pink tips of the papillæ.

Deposits.—Numerous tables, dichotomously X-shaped rosettes and C-shaped bodies. Tables generally small compared with other species of the genus *Holothuria.* Disk of table with four large and few small holes, the spire with four pillars and two cross-beams. Rosettes and C-shaped bodies typical. Pedicels with regular end-plate and supporting rods, the latter with partly spinous ends and mid-shaft dilated into asymmetrical perforated plates.

Remarks.—Apparently found in many places in the Islands although not in abundance as the *Stichopus variegatus* Semper var. *hermanni* Semper. One specimen of this species is with the collection of the Allan Hancock Foundation donated by the writer.

Specimens examined:

Acc. No.	Locality	Date	Quantity
1204–AHF	Zamboanga waters	1950	1

STICHOPUS VARIEGATUS Semper var. HERMANNI Semper

Stichopus variegatus SEMPER var. *Hermanni* SEMPER (1868) 73, *pls. 17, 30, fig. 2;* H. L. CLARK (1922) 68; DOMANTAY (1933) 80–81, *pl. 2, fig. 2.*

Body quadrangular and elongated. Mouth ventral and anus terminal. With 20 peltate tentacles. Papillæ scattered all over dorsal and lateral sides with those of the dorso- and ventro-lateral ambulacra very prominent in life. Pedicels numerous arranged in three distinct bands on trivium with the medium band much wider than the laterals. Body-wall thick but not hardy, easily disintegrate after removal from the water when mechanically abraded. Color in life greenish-brown or greenish-orange with shades of brown and many fine incomplete dark green striations on dorsal interambulacrum. Tip of papillæ bright scarlet red. Younger specimens show more shades of green giving a dark-green appearance and the tips of the papillæ are not conspicuously colored.

Deposits.—Numerous tables and C-shaped bodies like those found in *Stichopus variegatus* Semper without any difference. The dichotomously X-shaped rosettes are oftenly missed in large specimens, hence apparently found only in smaller younger materials. Pedicels with regular end-plate, and together with the papillæ are the large supporting rods of different forms, one of which is not found in the straight species which is a large partly spinous branching supporting rod.

Remarks.—Practically found in many places in the Islands and more abundant than the straight species. Has been cured for commercial trade but the quality is poor and may be good only for fertilizer. One specimen in bad shape is with the collection of the Allan Hancock Foundation donated by the writer.

Specimens examined:

Acc. No.	Locality	Date	Quantity
1204–AHF	Marine Biological Ground, Zamboanga	1949	1
114–Za	Marine Biological Ground, Zamboanga	6–4–51	2
114–Zb	Zamboanga waters	6–7–51	6
114–Zc	Zamboanga waters	6–9–51	2

STICHOPUS HORRENS Selenka

Stichopus horrens SELENKA (1867) 316, *pl. 18, figs. 27–29*; H. L. CLARK (1922) 64–66, *pl. 2, figs. 19–23*; DOMANTAY (1933) 78–79, *pl. 3, fig. 1.*
Stichopus godeffroyi SEMPER (1868) 75, *pl. 30, fig. 4.*
Stichopus godeffroyi var. *pygmæus* SEMPER (1868) 75.
Stichopus godeffroyi var. *b.* SEMPER (1868) 246.
Stichopus tropicalis FISHER (1907) 676, *pl. 70, figs. 1–11.*

Body sub-quadrangular and elongated. Mouth ventral and anus terminal. With 20 short peltate tentacles. Papillæ arranged in four irregular rows along each of the dorso- and ventro-lateral ambulacra and none over the interambulacral area. In bigger or older individuals, according to H. L. Clark, the papillæ developed on the dorsal interambulacral area as in *S. godeffroyi* var. *b,* Semper and *S. tropicalis* Fisher. Numerous pedicels arranged in three distinct bands on the trivium, the median row much wider than the laterals. Body-wall delicate and pellucid, almost transparent. In bigger individuals the integument is no longer transparent but somewhat olive-green mottled with darker shades on bivium and cream-color on trivium. Apparently color changes with the age of the animal. One of the specimens I examined in the Puerto Galera Marine Biological Station is somewhat variegated in color. Always found among rocks and corals usually covered apparently due to its tender and delicate integument.

Deposits.—Tables, rosettes and C-shaped bodies. The tables of two kinds, one big with a conical spire ending in single point with large perforated disk, and another one smaller with spire ending like a spinous crown. The rosettes are dichotomously X-shaped which together with the C-shaped bodies are almost typical to the other species of the genus. Pedicels with the regular end-plate and supporting rods, the latter resembling that of the *S. variegatus* Semper to some extent. According to the findings of H. L. Clark the tables undergo growth-changes with the age of the animal and that the C-shaped bodies appear at a certain stage in the life of the individual which marks the *horrens* stage, *sensu strictu.*

Specimens examined:

Acc. No.	Locality	Date	Quantity
115–Za	Marine Biological Ground, Zamboanga	1950	1
115–Zb	Marine Biological Ground, Zamboanga	1951	1

Genus THELENOTA Brandt, 1835

THELENOTA ANANAS (Jaeger)

Trepang ananas JAEGER (1833) 24, *pl. 3, fig. 1.*
Holothuria (Thelenota) ananas BRANDT (1835) 253.
Stichopus ananas SEMPER (1868) 75; SLUITER (1901) 30, *pl. 2, fig. 1*; MITSUKURI (1912) 150, *pl. 1, figs. 6–8, text-fig. 25*; THEEL (1886a) 196.
Thelenota ananas H. L. CLARK (1921) 184, *pl. 18, fig. 2*; DOMANTAY (1933) 81–82, *pl. 1, fig. 5.*

Body subquadrangular and elongated. Mouth ventral and anus terminal. With 20 peltate tentacles. Papillæ on bivium large, conically compressed with their bases united together forming semi-starlike appendages. Numerous large pedicels arranged irregularly on the trivium. Body-wall very thick and hardy. Color in life light brown with dark brown spots and fine transverse black striations on bivium. Papillæ reddish-orange. In dried or preserved state the color is uniformly brown all over the body. Large size, the average length is around 400 mm.

Deposits.—Simple and dichotomously branched rods and innumerable minute oval granules. Some simple rods smooth, slightly curved and pointed at both ends, others irregular, more or less spinous and some branched at both ends. Dichotomously branched rods ranged from simple X-shaped to complex rosette. Tip of pedicel with regular end-plate. Some of the dichotomously X-shaped rosettes resemble that of *Holothuria (Actinopyga) formosa* (Selenka) in Panning (1929) 130, *text-fig. 14.*

Remarks.—Common all over the Islands and used mostly for *trepang* or *beche-de-mer.* Five cured specimens are with the collections of the Allan Hancock Foundation donated by the writer, transferred to alcoholic solution.

Specimens examined:

Acc. No.	Locality	Date	Quantity
1204–AHF	Zamboanga waters	1950	6
116–Z	Zamboanga waters	6–7–51	1

Order APODA Brandt, 1835

Family SYNAPTIDÆ Ostergren, 1905

Genus SYNAPTA Eschscohltz, 1829

SYNAPTA MACULATA (Chamisso and Eysenhardt)

Holothuria maculata CHAMISSO and EYSENHARDT (1821) 352.
Synapta mammillosa ESCHSCOHLTZ (1829); JAEGER (1833).
Holothuria oceanica LESSON (1830).

Synapta beselii JAEGER (1833); SEMPER (1868); THEEL (1886a).
Synapta oceanica JAEGER (1833).
Synapta astrolabi HELD (1857).
Synapta beselii TENNISON-WOODS (1880).
Chondrochlæa beselii OSTERGREEN (1898b).
Synapta maculata JAEGER (1833); H. L. CLARK (1907); (1924) 471–473, *pl. 8, figs. 1–2*; *pl. 4, fig. 1*; *pl. 5*; DOMANTAY (1933) 89–90; *pl. 2, fig. 7.*

Body long cylindrical and snake-like when under water. Mouth and anus terminal. With 14 to 15 pinnate tentacles. In life measures as long as three meters when extended, with five distinct longitudinal bands of two or three different colors crossed by incomplete irregular bands of variegated brown of darker and lighter shades alternated by black. Body surface rough and sticks to the skin when handled due to prominent anchors sticking outward from the integument. At times when external condition becomes abnormal due apparently to rise in temperature when partly exposed during low tide the body forms prominent folds in alternation along the whole length known as *verrucæ*. This may vary greatly with size and nature of contraction of the animal. May be absent altogether in preserved specimens.

Deposits.—Large anchors and anchor-plates and numerous miliary granules. Anchor-plate almost as long as the shaft of the anchor, with a central hole surrounded by six to seven similar ones and many smaller ones at both ends. At the posterior end are two bows making that portion of the plate appear double. Anchor very large with finely spinous stock, smooth arms and with few very minute spherical knobs at the apex, either in a single central series or in short series on each side, or may be wanting altogether even in fully developed ones. Miliary granules very numerous and irregular rosette-like in form.

Specimens examined:

Acc. No.	Locality	Date	Quantity
117–Za	Marine Biological Ground, Zamboanga	6–11–51	1
117–Zb	Marine Biological Ground, Zamboanga	6–11–51	4

OPHEODESOMA SPECTABILIS Fisher var. PUERTO-GALERÆ Domantay

Opheodesoma spectabilis FISHER var. *puerto-galeræ* DOMANTAY (1933) 86–87, *pl. 2, fig. 10.*

Body tubular and worm-like when under water. Mouth and anus terminal. With 12 to 15 pinnate tentacles. Body-wall thin and rough to the touch due to anchors. When ex-

tended under water the body looks smooth but when partly contracted due to abnormal external conditions the integument may show five regular series of numerous folds or *verrucæ* extending the whole length of the animal. Color in life brownish-green to dark green with some irregular longitudinal lighter stripes with numerous minute white specks. Alternation of brownish-green and lighter color with numerous minute white specks forming transverse bands may be seen in others. Apparently small size, the average length is around 300 mm.

Deposits.—Anchors, anchor-plates and miliary granules. Stock of anchor with 6 to 8 spinous projections. Vertex and arms smooth although in some the former may be seen with few minute spherical knobs. Anchor-plate with a small handle and distinct neck separating it from the plate. Handle with three small holes, sometimes with additional minutes ones, and with a small semi-lunar bow not attached to the neck. The body of the anchor-plate with one central and six peripheral dentate holes. Numerous miliary granules, disc-shaped, some with tiny hole.

Specimens examined:

Acc. No.	Locality	Date	Quantity
118–Za	Marine Biological Ground, Zamboanga	3–9–51	10
118–Zb	Marine Biological Ground, Zamboanga	6–11–51	6

Genus POLYPLECTANA H. L. Clark, 1907

POLYPLECTANA KEFERSTEINII (Selenka)

Synapta kefersteinii SELENKA (1867) 360.
Synapta kallipeplos SLUITER (1888).
Chondrocloea kefersteinii OSTERGREN (1898h).
Synaptula kefersteinii FISHER (1907).
Polyplectana kefersteinii H. L. CLARK (1907); (1908) 16, 77; (1924) 468–471; *pl. 1, figs. 8–12*; DOMANTAY (1933) 88, *pl. 2, fig. 8.*

Body tubular and worm-like when under water. Mouth and anus terminal. With 13 to 25 pinnate tentacles. Integument thin and smooth. Color in life reddish-brown to dark brown and more or less speckled with lighter shade. Body-wall somewhat delicate, does not preserve very well. In life body surface slightly rough to the touch due to anchors.

Deposits.—Anchors, anchor-plates and miliary granules. Stock of anchor without distinct processes but rather finely spinous resembling that of *Synapta maculata* (Chamisso and Eysenhardt). Arms smooth with few minute spherical knobs on vertex. Anchor-plate symmetrical with one central and six large peripheral dentate holes, one of which, the one toward

the handle is smaller, partly dentated and slightly heart-shaped. Handle without distinct neck and with two large and several small smooth holes. Bow of handle partly dentated on posterior border. Miliary granules irregular in shape and size from rod-shape to rosette.

Specimens examined:

Acc. No.	Locality	Date	Quantity
119–Z	Marine Biological Ground, Zamboanga	6–11–51	3

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A BRIEF SUMMARY OF THE PACIFIC AND ATLANTIC HOLOTHURIOIDEA OF THE ALLAN HANCOCK FOUNDATION COLLECTIONS *

By Jose S. Domantay
Of the Bureau of Fisheries, Manila

INTRODUCTION

The writer in February, 1949 to July, 1950, when officially detailed in the United States by the Philippine Government in connection with his research fellowship at the Allan Hancock Foundation of the University of Southern California in Los Angeles, was assigned to work on the tremendous Holothurian Collections of the Foundation.

The main bulk of the Holothurioidea Collections of the Foundation came from the Eastern Pacific along the entire area from Central America to the northern part of North America, composed of both littoral and deep-sea forms. The latter were mostly collected by the Velero boats of the Foundation. A small portion of the collections came from the Hawaiian Islands and from the West Pacific around the neighborhood of the Mariana Islands, mostly from Guam, collected by Mr. Fred C. Ziesenhenne when he was in the United States Navy during the early part of the last world war. A small Atlantic collection from the neighborhood of Florida also formed a part of the tremendous collections of the Foundation which Dr. Irene McCulloch had placed in the writer's responsibility.

The entire collections were gathered for the last 20 years from various sources and approximately composed of over 10,000 materials. The Pacific materials which constituted the main bulk of the collections, after a year and a half study at the Foundation, were found to be represented by 153 different species and varieties, 15 of which are new species and 17 new varieties. The Atlantic collection was represented by 27 different species and varieties, 4 of which are new species and 3, new varieties. The latter collection is very small compared with that of the Pacific, yet 10 out of the 27 different species and varieties of the Atlantic were also found in the Pacific.

* The writer regrets publication of this summary without the prior but anticipated permission of the Hancock Committee on Research Supervision, not withstanding his effort exerted in withdrawing it from its advanced stage of printing. He therefore assumes sole responsibility for this paper.

The following species are found in both Pacific and Atlantic Oceans:

Holothuria atra Jaeger
H. cubana Ludwig
H. arenicola Semper
H. glaberrima Selenka
H. surinamensis Ludwig
H. impatiens Pourtales
Stichopus badionatus Selenka
Phyllophorus zacæ Deichmann
Euapta godeffroyi (Semper)
Polyplectana kefersteinii (Selenka)

The presence of the above listed species in both Pacific and Atlantic is not unusual because of the water connection of the two oceans through Central America during the Paleozoic, Mesozoic, and Tertiary periods, as well as during the Eocene, Oligocene and Miocene when the direct connection existed without interruption.

The following systematic lists of Holothurioidea were described and illustrated in four manuscripts, three of which were left at the Allan Hancock Foundation:

1. The Eastern Pacific Holothurioidea of the Allan Hancock Foundation collection.
2. Some littoral holothurians from Guam and vicinity.
3. Littoral holothurians from Zamboanga and vicinity.
4. Some littoral holothurians from Florida.

Due to lack of time the first manuscript was not placed in its final form when the writer left for the Islands in August, 1950. All the different species and varieties were described separately in loose sheet of papers and later put together in accordance with the systematic list submitted. The bibliography was made accordingly in the writer's index file. The illustrations of spicules for each particular species drawn by the artist were all labelled accordingly. All of these things were left to Dr. I. McCulloch with the request that she goes over them for the publication of the Foundation.

The second and third manuscripts were presented as reports to comply with two three-unit research courses registered in absentia at the University of Southern California. The fourth manuscript is also in the possession of Dr. Erene McCullock.

PACIFIC HOLOTHURIOIDEA OF THE ALLAN HANCOCK FOUNDATION COLLECTIONS

Order ASPIDOCHIROTA Grube, 1840

Family HOLOTHURIIDÆ Ludwig

Genus HOLOTHURIA Linnæus, 1758

1. *Holothuria albiventer* Semper
2. *H. altimensis* Clark
3. *H. anulifera* Fisher
4. *H. arenicola* Semper
5. *H. arenicola* Semper var. *boutani* Herouard
6. *H. argus* (Jaeger)
7. *H. atra* Jaeger
8. *H. bowensis* Ludwig
9. *H. cinerascens* (Brandt)
10. *H. cubana* Ludwig
11. *H. curiosa* Ludwig
12. *H. curiosa* Ludwig var. *pervicax* Selenka
13. *H. curiosa* Ludwig var. *fusco-rubra* Theel
14. *H. edulis* Lesson
15. *H. glaberrima* Selenka
16. *H. gyrifer* (Selenka)
17. *H. hawaiiensis* Fisher var. *benedicti* n. var.
18. *H. imitans* Ludwig
19. *H. impatiens* (Forskål)
20. *H. impatiens* (Forskål) var. *ludingæ* n. var.
21. *H. inornata* Semper
22. *H. languens* Selenka
23. *H. lentiginosa* Marenzeller
24. *H. lengtiginosa* Marenzeller var. *clarionensis* n. var.
25. *H. lubrica* Selenka
26. *H. Marenzelleri* Ludwig var. *theeli* Deichmann
27. *H. modesta* Ludwig
28. *H. fisheri* n. sp. *
29. *H. mortenseni* n. sp. *
30. *H. neozelanica* Mortensen
31. *H. ocellata* Jaeger
32. *H. paradoxa* Selenka
33. *H. papillata* Bell
34. *H. papillata* Bell var. *galapagosensis* n. var.
35. *H. pardalis* Selenka
36. *H. princeps* Selenka
37. *H. pseudofossor* Deichmann
38. *H. pulla* Selenka
39. *H. rugosa* Ludwig
40. *H. sanctori* Delle Chiaje
41. *H. scabra* Jaeger
42. *H. surinamensis* Ludwig
43. *H. vitiensis* Semper

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* Named after Dr. Walter K. Fisher and the late Dr. Th. Mortensen, respectively.

Genus ACTINOPYGA Bronn

44. *Actinopyga echinites* (Jaeger)
45. *A. echinites* (Jaeger) var. *bertini* n. var.
46. *A. mauritiana* (Qouy and Gaimard)
47. *A. miliaris* (Qouy and Gaimard)
48. *A. miliaris* (Qouy and Gaimard) var. *zamboanganensis* n. var.

Genus MICROTHELE Brandt, 1835

49. *Microthele nobilis* (Selenka)

Genus LABIDODEMAS Selenka, 1867

50. *Labidodemas americanum* Deichmann

Family STICHOPIDÆ Brandt, 1835

Genus PARASTICHOPUS H. L. Clark, 1922

51. *Parastichopus californicus* (Stimpson)
52. *P. johnsoni* Theel
53. *P. nigripunctatus* (Agustin)
54. *P. parvimensis* (H. L. Clark)

Genus STICHOPUS Brandt, 1835

55. *Stichopus badionatus* Selenka
56. *S. chloronotus* Brandt
57. *S. variegatus* Semper
58. *S. horrens* Selenka

Genus THELENOTA Brandt, 1835

59. *Thelenota ananas* (Jaeger)

Family SYNALLACTIDÆ Ludwig, 1894

Genus MESOTHURIA Ludwig, 1894

60. *Mesothuria carnosa* Fisher

Genus BATHYPLOTES Ostergren, 1896

61. *Bathyplotes hancocki* n. sp.*
62. *B. macullochæ* n. sp.*
63. *B. veleronis* n. sp.*

Order ELASIPODA Theel, 1886

Family LÆTMOGONIDÆ Ekman, 1925

Genus LÆTMOPHASMA Ludwig, 1894

64. *Lætmophasma fecundum* Ludwig

Family PELAGOTHURIIDÆ Ludwig, 1894

Genus PELAGOTHURIA Ludwig, 1894

65. *Pelagothuria natatrix* Ludwig

* Named after Dir. Allan Hancock of the Foundation; Dr. Irene McCulloch, and the Marine Floating Laboratory of the Allan Hancock Foundation, respectively.

Order DENDROCHIROTA Grube, 1840

Family PHYLLOPHORIIDÆ Grube, 1840

Genus EUTHYONIDIUM Deichmann, 1941

66. *Euthyonidium ovulum* (Selenka)
67. *E. veleronis* Deichmann

Genus ATHYONIDIUM Deichmann, 1941

68. *Athyonidium deichmannæ* n. sp.*
69. *A. chilensis* (Semper)

Genus PHYLLOPHORUS Grube, 1840

70. *Phyllophorus panningi* n. sp.*
71. *P. zacæ* Deichmann

Family CUCUMARIIDÆ Blainville, 1834

Genus CUCUMARIA Blainville, 1834

72. *Cucumaria analis* Vaney var. *Sonoræ* n. var.
73. *C. californica* Semper
74. *C. crocea* Lesson var. *croceoides* (Vaney)
75. *C. elongata* Duben and Koren
76. *C. elongata* Duben and Koren var. *californica* n. var.
77. *C. sykion* (Lampert)
78. *C. miniata* (Brandt)
79. *C. calcigera* (Stimpson) var. *catalinensis* n. var.
80. *C. populifera* Stimpson
81. *C. pseudocurata* Deichmann
82. *C. curata* Cowles
83. *C. saxicola* Brady and Robertson
84. *C. steineni* Ludwig
85. *C. crax* Deichmann
86. *C. crax* Deichmann var. *dotæ* n. var.

Genus APENTAMERA Deichmann, 1941

87. *Apentamera lepra* Deichmann

Genus PENTAMERA Ayres, 1852

88. *Pentamera chierchia* (Ludwig)
89. *P. pseudocalcigera* Deichmann
90. *P. pseudopopulifera* Deichmann
91. *P. charlottæ* Deichmann

Genus NEOTHYONE Deichmann, 1941

92. *Neothyone gibber* (Selenka)
93. *N. villadolidi* n. sp.*
94. *N. sacellus* (Selenka)
95. *N. gibbosa* Deichmann

Genus EUPENTACTA Deichmann, 1941

96. *Eupentacta quinquesemita* (Selenka)
97. *E. pseudoquinquesemita* Deichmann var. *rosæ* n. var.
98. *E. quinquesemita* (Selenka) var. *cari* n. var.

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* Named after Dr. Elizabeth Deichmann, Dr. A. Panning, and Dr. Deogracias V. Villadolid, Director of Fisheries, Philippines, respectively, who is instrumental in the writer's official detail in the United States.

Genus LEPTOPENTACTA H. L. Clark, 1938

99. *Leptopentacta nina* Deichmann
100. *L. nova* Deichmann
101. *L. macullochæ* n. sp.*
102. *L. nova* Deichmann var. *colombiana* n. var.

Genus PACHYTHYONE Deichmann, 1941

103. *Pachythyone rubra* (H. L. Clark)
104. *P. lugubris* Deichmann
105. *P. pseudolugubris* Deichmann

Genus THYONACTA Deichmann, 1941

106. *Thyonacta mexicana* Deichmann

Genus THYONE Oken, 1815

107. *Thyone colnettensis* n. sp.
108. *T. belli* Ludwig
109. *T. benti* Deichmann
110. *T. bidentata* Deichmann
111. *T. ceciliæ* n. sp.*
112. *T. glasselli* Deichmann
113. *T. inermis* Heller var. *coronensis* n. var.
114. *T. lechleri* Lampert
115. *T. neofusus* Deichmann
116. *T. strangeri* Deichmann
117. *T. turricata* Vaney var. *lourdesæ* n. var.
118. *T. unisemita* (Stimpson)

Genus ANAPERUS Troschel

119. *Anaperus peruviana* (Lesson)

Family PSOLIDÆ Oken, 1815

Genus PSOLUS Oken, 1815

120. *Psolus antarticus* Philippi
121. *P. buchannani* n. sp.*
122. *P. chitonoides* H. L. Clark
123. *P. pourtalesi* Theel
124. *P. squamatus* (Koren) var. *segregatus* Perrier
125. *P. valvatus* Ostergren

Genus PSOLIDIUM Ludwig, 1887

126. *Psolidium eubullatum* Deichmann
127. *P. dorsipes* Ludwig
128. *P. dorsipes* Ludwig var. *gadieli* n. var.
129. *P. granuliferum* H. L. Clark
130. *P. planum* Deichmann

Genus THYONEPSOLUS H. L. Clark, 1901

131. *Thyonepsolus hancocki* Deichmann
132. *T. nutriens* H. L. Clark
133. *T. veleronis* Deichmann

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* Named after Dr. Irene McCulloch who was directly responsible for the writer's research fellowship at the Foundation; the writer's wife, Cecilia; Dr. James W. Buchanan, Research Director of the Allan Hancock Foundation, respectively.

Order MOLPADIA Hæckle

Family MOLPADIDÆ Cuvier, 1817

Genus MOLPADIA Cuvier, 1817

134. *Molpadia musculus* Risso
135. *M. arenicola* (Stimpson)
136. *M. intermedia* (Ludwig)

Genus CERAPLECTANA H. L. Clark, 1907

137. *Ceraplectana buchannani* n. sp.*

Family CAUDINIDÆ

Genus PARACAUDINA Heding, 1931

138. *Paracaudina clarki* n. sp.*

Family GEPHYROTHURIIDÆ Deichmann

Genus GEPHYROTHURIA Koehler and Vaney, 1905

139. *Gephyrothuria alcocki* Koehler and Vaney
140. *G. veleroa* n. sp.*

Order APODA Brandt, 1835

Family SYNAPTIDÆ Ostergren, 1905

Genus EUAPTA Ostergren, 1905

141. *Euapta godeffroyi* (Semper)

Genus SYNAPTA Eschscholtz, 1829

142. *Synapta maculata* (Chamisso and Eysenhardt)

Genus OPHEODESOMA Fisher, 1907

143. *Opheodesoma spectabilis* Fisher
144. *O. spectabilis* Fisher var. *puerto-galeræ* Domantay

Genus POLYPLECTANA H. L. Clark, 1907

145. *Polyplectana kefersteini* (Selenka)

Genus ANAPTA Semper, 1868

146. *Anapta subtilis* Sluiter

Genus LEPTOSYNAPTA Verrill, 1867

147. *Leptosynapta circopatina* H. L. Clark
148. *L. inhærens* (O. F. Muller)
149. *L. latipatina* H. L. Clark

Family CHIRIDOTIDÆ Ostergren, 1905

Genus CHIRIDOTA Eschscholtz, 1829

150. *Chiridota uniserialis* Fisher var. *clementensis* n. var.
151. *C. rigida* Semper
152. *C. violacea* John Muller

Genus TOXODORA Verrill, 1867

153. *Toxodora pacifica* Oshima

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* Named after Dr. James W. Buchanan; the late Dr. Hubert L. Clark, who was instrumental in the writer's research fellowship at the Hancock Foundation; and the former Velero III of the Foundation, respectively.

ATLANTIC HOLOTHURIOIDEA OF THE ALLAN HANCOCK FOUNDATION COLLECTIONS

Order ASPIDOCHIROTA Grube, 1840

Genus HOLOTHURIA, Linnæus, 1758

1. *Holothuria atra* Jaeger
2. *H. floridana* Pourtales
3. *H. mexicana* Ludwig
4. *H. grisea* Selenka
5. *H. cubana* Ludwig
6. *H. arenicola* Semper
7. *H. glaberrima* Selenka
8. *H. surinamensis* Ludwig
9. *H. tubulosa* Gmelin
10. *H. impatiens* Pourtales

Genus ACTINOPYGA Bronn

11. *Actinopyga agassizi* (Selenka)

Genus STICHOPUS Brandt, 1835

12. *Stichopus badionatus* Selenka

Order DENDROCHIROTA Grube, 1840

Genus PHYLLOPHORUS Grube, 1840

13. *Phyllophorus zacæ* Deichmann
14. *P. occidentalis* Ludwig

Genus NEOTHYONE Deichmann, 1941

15. *Neothyone capensis* (Theel) var. *trojani* n. var.

Genus LEPTOPENTACTA H. L. Clark, 1938

16. *Leptopentacta deichmannæ* n. sp.*
17. *L. nova* Deichmann var. *floridana* n. var.
18. *L. nova* Deichmann var. *gemmata* n. var.

Genus LUDWIGIA Panning, 1948

19. *Ludwigia americana* n. sp.

Genus THYONE Oken, 1815

20. *Thyone pervicax* Theel
21. *T. pseudofusus* Deichmann
22. *T. fusus* (O. F. Muller)
23. *T. floridana* n. sp.
24. *T. clarki* n. sp.*
25. *T. tenella* Selenka

Order APODA

Genus EUAPTA Ostergren, 1905

26. *Euapta godeffroyi* (Semper)

Genus POLYPLECTANA H. L. Clark, 1907

27. *Polyplectata kefersteinii* (Selenka)

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* Named after Dr. Elizabeth Deichmann, Curator of Zoology, Museum of Comparative Zoology of Harvard, Cambridge; and the late Dr. Hubert L. Clark, former Curator of Zoology of the same Museum, respectively.

RECORDS AND DESCRIPTIONS OF JAPANESE TIPULIDÆ (DIPTERA), PART II

THE CRANE-FLIES OF SHIKOKU, II

By Charles P. Alexander
Of Amherst, Massachusetts

FOUR PLATES

The present report continues the recording of the Tipulidæ of Shikoku, as discussed and planned in the initial part under this title. I wish to express my deep thanks and appreciation to my Japanese colleagues, Messrs. Esaki, Harukawa, Ishihara, Issiki, Ito, Miyataki, Mutuura, Yano, and others for their efforts to make known the rich crane-fly fauna of the island. Through their friendly interest, the types of the various novelties are retained in my collection, with duplicates and named specimens being returned to the various institutions that have participated in the study.

RECORD OF DISTRIBUTION

TIPULINÆ

61. TANYPTERA PERANGUSTA sp. nov. **Plate 1, figs. 1, 7, 8.**

Size relatively small (wing, less than 12 millimeters); general coloration black, abdomen of male largely yellow; wings with a yellowish tinge, the basal and costal regions clearer yellow; stigma oval, dark brown, confluent with a large brown cloud over the anterior cord; male hypopygium with the outer dististyle pale, broad basally, gradually narrowed to an acute terminal spine; inner dististyle darkened, virtually parallel-sided, the lower apical angle produced into a short point.

Male.—Length, about 12.5 to 13 millimeters; wing, 10 to 10.5.

Female.—Length, about 14 millimeters; wing, 11.

Rostrum black; palpi obscure yellow, the terminal segment chiefly blackened. Antennæ (male) with scape brown, pedicel and axis of the flagellum yellow, the branches and axes of outer segments dark brown; branch of first flagellar segment stout, uniformly yellow, of the second segment exceeding one-third the length of the basal branch; succeeding segments with the outer branch dusky apically. Head polished black.

Pronotum brownish yellow, blackened on sides. Mesonotum black, the dorsopleural membrane whitened. Pleura black. Halteres pale yellow. Legs with all coxæ black; trochanters yellow, femora yellow, the tips narrowly and abruptly black, with about the outer sixth or seventh included; tibiæ brownish yellow, the tips more narrowly blackened, the base less evidently infuscated; tarsi black, the proximal end of basitarsus obscure yellow. Wings (Plate 1, fig. 1) with a yellow tinge, the basal and costal regions clearer yellow; stigma oval, dark brown, confluent with a large paler brown cloud over the anterior cord; veins dark brown, yellow in the flavous portions. Venation: R_{1+2} variable, from entirely preserved to entirely atrophied, in the former case suberect and in approximate alignment with R_2; petiole of cell M_1 from one-half to three-fourths the cell.

Abdomen (male) yellow, the first tergite and a broad central stripe on the succeeding tergites blackened, narrowly interrupted on posterior part of the segments, leaving broad lateral borders that are narrowest in front; hypopygium and preceding segment black. In the female, abdomen black, the subterminal tergite very narrowly bordered posteriorly by yellow. Cerci large, sabre-shaped, chestnut-brown. Male hypopygium (Plate 1, fig. 8) with the outer dististyle pale, broadest at base, gradually narrowed to the acute blackened point; surface with abundant pale setæ, those of outer surface unusually abundant, long and erect. Inner distisytle, *d*, dark colored, blackened along lower margin, nearly as long as outer style, beyond the slightly dilated base being virtually parallel-sided, the apex subtruncated, the lower apical angle produced into a short point.

In *angustistyla* (Plate 1, fig. 7) the outer dististyle, *d*, is widened basally but only slightly narrowed outwardly, at apex bent mesad into an acute blackened point; inner dististyle slender, gradually narrowed outwardly.

Habitat.—Japan (Shikoku).

Holotype, male, Iwai, near Imanoyama, Tosa, altitude 200 meters, May 11, 1951 (*Issiki-Ito*). Allotopotype, female, pinned with type. Paratopotypes, 2 males.

The only similar small sized regional member of the genus is *Tanyptera angustistyla* Alexander, which differs especially in the details of structure of the male hypopygium, as described and figured.

62. DOLICHOPEZA (NESOPEZA) CIRCULANS sp. nov. **Plate 1, figs. 2, 4.**

General coloration medium brown to cinnamon brown; legs brown, the outer tarsal segments paling to yellow; wings strongly infuscated, the small oval stigma slightly darker brown, relatively inconspicuous; no pale post-stigmal area; Rs short, arcuated; cell M_1 nearly twice its petiole; male hypopygium with the posterior border of the tergite heavily blackened, trilobed, the lobes without spicules; eighth sternite narrowed outwardly, the posterior border produced ventrad into two setiferous lobes that are separated by a broad rounded notch.

Male.—Length, about 10 millimeters; wing, 11.

Frontal prolongation of head short, brown, without a nasus but with long conspicuous setæ, the longest only a little shorter than the prolongation itself; palpi brown, the terminal one exceeding the others combined. Antennæ with the scape and pedicel pale brown, the latter yellowed apically; flagellum broken. Head brown, the low vertical tubercle slightly compressed, obscure brownish yellow.

Thorax almost uniformly medium brown to cinnamon brown, the surface opaque; præscutum with indications of four very slightly darker stripes; centers of scutal lobes and the scutellum somewhat darker than the ground. Halteres brown. Legs with the coxæ brown; trochanters obscure yellow; remainder of legs brown, the outer tarsal segments paling to yellow. Wings (Plate 1, fig. 2) strongly infuscated, the relatively small oval stigma slightly darker brown, inconspicuous; no pale post-stigmal area; veins brown. Venation: Rs short, arcuated, subequal to m-cu; cell M_1 nearly twice its petiole; m-cu about one-third its length before fork of M; cell M_4 moderately deep, the distal section of vein Cu_1 about twice m-cu; cell 2nd A relatively broad.

Abdominal tergites dark cinnamon brown, the borders narrowly darker brown; basal sternites brownish yellow, the posterior margins narrowly darker; outer segments, including the hypopygium, dark brown. Male hypopygium (Plate 1, fig. 4) with the posterior border of the ninth tergite, *9t*, heavily blackened, without spicules, trilobed, the median lobe lower. Outer dististyle, *d*, dusky, from four to four and one-half times as long as broad. Gonapophysis, *g*, appearing as a flattened blade, narrowed on outer third, the lower apical angle produced into a small point. Eighth sternite, *8s*, narrowed outwardly, the posterior border produced ventrad into two

lobes that are separated by a broad rounded notch, the lobes provided with coarse setæ.

Habitat.—Japan (Shikoku).

Holotype, male, Omogokei, Iyo, July 22, 1949 (*Miyatake*).

The most similar regional species is *Dolichopeza* (*Nesopeza*) *tarsalis* Alexander, which differs in the coloration of the body and wings, details of venation, and particularly the structure of the male hypopygium, especially the tergite, gonapophysis and eighth sternite.

63. DOLICHOPEZA (NESOPEZA) IDIOPHALLUS (Alexander).

Nesopeza idiophallus ALEXANDER, Philip. Jour. Sci. 40 (1929) 324–325, *pl. 2, fig. 27* (♂ hypopygium, ædeagus).

TOSA: Imanoyama, altitude 800 meters, May 12, 1951 (*Issiki-Ito*). Described from Chekiang, eastern China, but later found in Japan.

64. DOLICHOPEZA (OROPEZA) CANDIDIPES (Alexander).

Oropeza candidipes ALEXANDER, Ent. Soc. America Ann. 14 (1921) 122.

Oropeza candidipes ESAKI, et al., Icon. Insect. Japan Ed. 2 (1950) 529, *fig.*

AWA: Mount Tsurugi, Kawati, altitude 400 meters, May 29, 1950 (*Issiki-Ito*); Minokosi, altitude 1,400 meters, to Nagoro, altitude 900 meters, June 1, 1950 (*Issiki-Ito*); Sugeoi, June 4, 1950 (*Issiki-Ito*).

65. DOLICHOPEZA (OROPEZA) INOMATAI Alexander.

Dolichopeza (*Oropeza*) *inomatai* ALEXANDER, Philip. Jour. Sci. 51 (1933) 370–371, *pl. 1, fig. 1* (venation), *pl. 2, fig. 25* (♂ hypopygium).

TOSA: Mount Imanoyama to Iwai, altitude 200 meters, May 11, 1951 (*Issiki-Ito*); Mount Imanoyama, altitude 800 meters, May 12, 1951 (*Issiki-Ito*).

66. DOLICHOPEZA (OROPEZA) SAITAMENSIS Alexander.

Dolichopeza (*Oropeza*) *saitamensis* ALEXANDER, Philip. Jour. Sci. 43 (1930) 510–511, *pl. 2, figs. 29, 30* (♂ hypopygium).

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki-Ito*); Nagoro to Sugeoi, June 3, 1950 (*Issiki-Ito*).

The male hypopygium of this material and some other specimens from Honshu do not show the apices of the lateral tergal arms as distinctly roughened as in the holotype. Mention should be made of the abundant setulæ on the mesal face of

the basistyle, providing an extensive area with a cushion-like appearance.

67. NEPHROTOMA CORNICINA (Linnaeus).

Tipula cornicina LINNÆUS, Syst. Nat. Ed. 10 (1758) 586.
Pachyrhina cornicina RIEDEL, Deutsch. Ent. Zeitschr. (1910) 432.
Pachyrhina cornicina CZIZZEK, Zeitschr. Mahresch. Landesmus. 11 (1911) 74–78, *fig. 11* (♂ hypopygium).
Pachyrhina cornicina BROLEMANN, Soc. Hist. Nat. Toulouse Bull. 51 (1923) 507–509, *pl. 10, figs. 1–8* (♂ hypopygium).
Nephrotoma cornicina ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1532, *fig.*
Pales cornicina MANNHEIMS, in Lindner, Die Fliegen Palaearkt. Reg. 167 (1951) 42.

IYO: Matsuyama, May 23, 1948 (*Miyatake*).
TOSA; Nahari, May 1, 1951 (*Issiki-Ito*).
Widely distributed over the Palæarctic Region, including eastern China and Kashmir.

68. NEPHROTOMA DAISENSIS Alexander. **Plate 1, fig. 5.**

Hitherto known only from the unique type female, taken on Mount Daisen, Hoki, Honshu.

Allotype, male, length, about 14 millimeters; wing, 14.5; antenna, about 3.1.

Characters virtually as in the holotype female except for the sexual characters. Frontal prolongation of head only narrowly blackened medially above, this including the nasus; palpi pale yellow throughout. Antennæ relatively short, as shown by the measurements, the flagellar segments less than the verticils; segments not or scarcely incised, merely a little enlarged basally.

Male hypopygium (Plate 1, fig. 5) with the ninth tergite, *9t*, produced caudally into two flattened lobes, their apices truncate, the upper surface with spicules that are directed outward, the more extensive ventral flanges with backwardly-directed points; on outer margin at base of each blade with a slender curved arm. Basistyle with an irregular brown thickening on mesal face. Outer dististyle, *d*, moderately long, the outer third strongly narrowed, the upper margin of basal half dilated. Inner dististyle, *d*, with the beak narrow; dorsal crest unusually high and conspicuous, pale, the margin divided into six acute points. Gonapophysis, *g*, appearing as a small oval blade, the stem short and stout. Eighth sternite, *8s*, transverse, widened outwardly, the caudal

margin truncated; median area of posterior border pale, provided with dense area of delicate yellow setulæ.

Allotype, male, Mount Tsurugi Sugeoi, Awa, June 4, 1950 (*Issiki-Ito*).

The somewhat remarkable male hypopygium readily distinguishes this fly from all other known species. In the high serrate dorsal crest of the inner dististyle it most resembles *Nephrotoma serristyla* Alexander, of China and eastern Siberia, an otherwise entirely distinct fly.

69. **NEPHROTOMA ELECTRIPENNIS sp. nov.** **Plate 1, fig. 3.**

Mesonotal præscutum polished yellow, with three polished brown stripes; an opaque blackened area opposite anterior end of the straight lateral stripes and a similar marking at each end of the suture; occipital brand very reduced; pronotum and postnotum yellow, the mediotergite with abundant delicate pale setæ; legs yellow, the outer tarsal segments more infuscated; wings tinged with pale yellow, unpatterned; veins black, conspicuous, those of the costal border paler; cell M_1 broadly sessile; abdomen yellow, the tergites with a broad brown central stripe and narrow lateral ones, all interrupted at the posterior borders of the segments.

Female.—Length, about 14 millimeters; wing, 14.

Frontal prolongation of head yellow; nasus distinct; basal segment of palpus yellow, the intermediate two more darkened, especially apically; terminal segment black. Antennæ with scape and pedicel light yellow; flagellum broken. Head above, including the high simple vertical tubercle, orange, the genæ and beneath more whitened; vague indications of a darker capillary median line and orbital spots; occipital brand very small and inconspicuous, pale gray.

Pronotum light yellow. Mesonotal præscutum polished yellow with three polished brown stripes, the lateral pair straight but with a very conspicuous opaque black area opposite its anterior end; scutum yellow medially, each lobe with a major brown area; lateral ends of suture velvety black, the mark bent caudad around the sides of the scutal lobe; scutellum testaceous yellow; mediotergite light yellow, vaguely patterned with darker behind, the surface with abundant microscopic pale setæ, inconspicuous because of their color; pleurotergite whitened, especially the katapleurotergite. Pleura whitened, variegated with more reddish areas on the ventral sternopleurite

and ventral anepisternum. Halteres pale, the apex of knob weakly darkened. Legs with the coxæ yellow, the fore pair a little darker; trochanters obscure yellow; femora and tibiæ yellow, the outer tarsal segments more infuscated. Wings (Plate 1, fig. 3) almost uniformly tinged with pale yellow, cell C a trifle more intense; stigma not differentiated from the ground, with about a dozen trichia; veins black, conspicuous, those of the prearcular and costal fields more yellowed. Venation: Sc_2 ending about opposite one-third to one-fourth Rs, the latter oblique, about one-third longer than the basal Section of R_{4+5}; free tip of Sc_2 virtually obliterated; cell M_1 broadly sessile; m-cu at point of forking of vein M_4.

Abdominal tergites yellow, with a broad dark brown central stripe extending from segment two to six, inclusive, broadly interrupted at the posterior borders; lateral tergal stripes much narrower; sternites yellow, with indications of a narrow broken median stripe from sternite two to the base of five; valves of ovipositor horn-yellow, the bases of the hypovalvæ brownish black.

Habitat.—Japan (Shikoku).

Holotype, female, Mount Tsurugi, Nagoro, Awa, altitude 900 meters, June 2, 1950 (*Issiki-Ito*).

The most similar regional species include *Nephrotoma atrolatera* Alexander, of Formosa, and *N. minuticornis* Alexander, of Japan, both differing evidently in the body coloration and in the details of venation. There seems to be no possible doubt as to the distinctness of the present fly, despite the present lack of the male sex.

70. NEPHROTOMA ESAKII Alexander. **Plate 2, fig. 11.**

Nephrotoma esakii ALEXANDER, Philip. Jour. Sci. 24 (1924) 596–597; 58 (1935) 226, *pl. 1, fig. 7* (venation) *pl. 3, fig. 36* (♂ hypopygium).

IYO: Mount Saragamine, altitude 1,271 meters, July 18, 1947 (*Miyatake*).

The somewhat noteworthy ovipositor is shown (Plate 2, fig. 11). Both the cerci and hypovalvæ appear as compressed yellow blades, with setæ virtually to their tips; cerci with apices obtuse, those of hypovalvæ acute.

This condition of the ovipositor is quite different from that found in most Holarctic species of the genus, where the cerci are elongate, sclerotized, and either blunt or acutely pointed

at tips. The condition in the western Palæarctic species is given by Mannheims.[1]

71. NEPHROTOMA FLAVONOTA (Alexander). **Plate 1, fig. 6.**

Pachyrhina flavonota ALEXANDER, Can. Ent. 46 (1914) 158–159, *pl. 11, fig. 5* (wing), *pl. 11, figs. 6, 15* (♂ hypopygium).

TOSA: Mount Imanoyama to Iwai, altitude 200 meters, May 13, 1951 (*Issiki-Ito*).

The figures accompanying the original description of this fly are insufficient and are supplemented herewith. Male hypopygium (Plate 1, fig. 6) with the ninth tergite, *9t*, transverse, the caudal margin with two broad lobes on either side of a narrow median emargination, all lobes with abundant black spicules. Basistyle, *b*, on mesal face with a bilobed or bilabiate dark sclerotized structure immediately above the darkened margin of the median incision of the ninth sternite, *9s*, the surface of the lobe microscopically roughened. Outer dististyle, *d*, unusually long and slender, tapering outwardly, often curved. Inner dististyle, *d*, pale, the beak long and slender, the lower beak reduced to a small conical tooth or point; postero-dorsal crest long and conspicuous when extended, in cases bent backward across the style and thus rendered inconspicuous, in cases the crest even larger than shown and more expanded outwardly; disk of style with unusually abundant retrorse setæ. Gonapophysis, *g*, appearing as a small flattened oval blade. Eighth sternite *8s*, large, sheathing, very slightly narrowed outwardly, terminating in two broad lobes that are separated by a V-shaped emargination filled with pale membrane, the lobes bearing abundant long yellow setæ.

The species is not only widely distributed in Japan but also occurs in eastern China.

72. NEPHROTOMA PULLATA (Alexander). **Plate 2, fig. 9.**

Pachyrhina pullata ALEXANDER, Can. Ent. 46 (1914) 160–162, *pl. 11, figs. 1* (wing), *12* (♂ antenna), *7, 14* (♂ hypopygium).

Nephrotoma hokkaidensis ALEXANDER, Ent. Soc. America Ann. 17 (1924) 446–447.

IYO: Matsuyama, April 19, May 13, 1949 (Yano); April 23, 1950 (*Miyatake*).

Male hypopygium (Plate 2, fig. 9) with the ninth tergite, *9t*, black, transverse, the caudal border produced into two spiculose lobes that are separated by a linear notch; each lobe with a

[1] Mannheims, B. In Lindner, Die Fliegen Palæarkt. Reg., Lief 167 (1951) 33, *figs. A, B.*

higher more ventral point to appear more or less bilobed. Outer dististyle, *d*, short and broad, the apical point short. Inner dististyle, *d*, long and narrow, without developed crests, the beak relatively slender. Gonapophysis, *g*, appearing as a long blade, the tip acute, subequal in length to the ædeagus. Eighth sternite, *8s*, broad, widened outwardly, the posterior margin entire; surface of sternite with very abundant short black setæ that are directed caudad.

Nephrotoma subpratensis Alexander, while being somewhat similar to the present fly in general coloration of the body and appendages, is a distinct species.

73. NEPHROTOMA SINENSIS (Edwards).

Pachyrrhina sinensis EDWARDS, Ann. and Mag. Nat. Hist. (8) 18 (1916) 268–269.

Nephrotoma sinensis ALEXANDER, Philip. Jour. Sci. 57 (1935) 145.

Nephrotoma sinensis ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1532, *fig.*

IYO: Mount Ishizuchi, altitude 1,000 meters, August 10, 1925 (*Harukawa*).

74. NEPHROTOMA VIRGATA (Coquillett). **Plate 2, fig. 10.**

Pachyrhina virgata COQUILLETT, U. S. Nat. Mus. Proc. 21 (1898) 306.

Pachyrhina virgata ALEXANDER, Can. Ent. 46 (1914) 163–164, *pl. 11, figs. 4* (wing), *10* (♂ antenna), *9, 13* (♂ hypopygium).

Nephrotoma virgata MASAKI, Tottori Soc. Agr. Science Trans. 4 (1933) 368–386, *2 pls.* (all stages); in Japanese.

Limnophila japonica ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1532, *fig.*

Pachyrhina serricornis BRUNETTI, Fauna Brit. India, Dipt. Nematocera (1912) 343; (erroneous determination).

IYO: Iwazeki, April 29, 1949 (*Yano*).

Male hypopygium (Plate 2, fig. 10) with the ninth tergite, *9t*, transverse, the posterior border produced into two lobes that are separated by a transversely oval notch; margins of lobes densely spiculose, their mesal ends produced inward, partially closing the notch; outer portion of lobe farther produced into a stout blade that narrows to an acute spine, the produced margin and base with a small number of spicules; dorsal surface of tergite on either side with relatively sparse long pale setæ. Ninth sternite on ventral part with a dark-colored microscopically spiculose structure that is directed ventrad. Outer dististyle, *d*, only moderately elongate, the apical point short. Inner dististyle, *d*, with the beak slender, lower beak short but conspicuous, directed outwardly; posterior

crest produced behind, glabrous; disk of style with pale, moderately abundant retrorse setæ; face of style from the beak backward with an elongated lacuna, widened behind. Phallosome with the gonapophysis, *g*, very small and weak diaphanous, much smaller than the darkened ædeagus, *a*. Eight sternite, *8s*, transverse, both the caudal and cephalic margins shallowly emarginate; posterior half with abundant weak setæ that become more numerous internally and are directed toward the median notch; posterior border, or the membrane immediately behind it, with a sclerotized ligula that is densely microscopically roughened, the structure directed cephalad toward the eighth sternite.

The very important paper by Masaki, cited above, considers the life history in detail and describes and figures all stages of this insect. This is evidently the species recorded by Brunetti from Yokohama as being *Nephrotoma serricornis* (Brunetti), a common and well known Indian species. While similar in general appearance, the two species are quite distinct and any record of *serricornis* from Japan at the present time should be deleted.

75. TIPULA (SCHUMMELIA) NIPPONENSIS Alexander.

Tipula nipponensis ALEXANDER, Can. Ent. 46 (1914) 236–237, *pl. 16, fig. 2* (wing), *pl. 19, fig. 2* (♂ hypopygium).
Tipula nipponensis ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1534, *fig.*

IYO: Dogo, near Matsuyama, March 31, 1946 (*Yano*); Omogokei, September 7, 1951 (*Miyatake*), a broken male, apparently of this species.

76. TIPULA (YAMATOTIPULA) NOVA Walker

Tipula nova WALKER, List Dipt. Brit. Mus. 1 (1848) 71.
Tipula fumifasciata BRUNETTI, Indian Mus. Rec. 6 (1911) 250; Fauna Brit. India, Dipt. Nematocera (1912) 308, *pl. 5, fig. 7* (wing).
Yamatotipula nohiræ MATSUMURA, Thous. Ins. Japan, Addit. 2 (1916) 461–462, *pl. 25, fig. 4* (whole ♀).
Tipula (*Yamatotipula*) *nova* ALEXANDER, Philip. Jour. Sci. 57 (1935) 108.
Tipula nova ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1536, *fig.*

IYO: Dogo, near Matsuyama, June 9, 1948, November 12, 1947 (*Yano*); Idai, near Matsuyama, May 12, 1949 (*Miyatake*); October 11 to 17, 1948 (*Ishihara-Miyatake*).
Matsuyama, at light trap, July 15, 1948, September 12, 1948,

77. TIPULA (ACUTIPULA) BULBIFERA sp. nov. **Plate 2, fig. 15**

General coloration of mesonotal præscutum light gray, the usual præscutal strips not or scarcely differentiated; antennæ (male) relatively long, the proximal flagellar segments weakly bicolored; posterior sclerites of notum and the pleura yellow; wings strongly tinged with brownish, stigma brown; a conspicuous whitened obliterative area before the anterior cord; basal abdominal segments yellow, the tergites with a conspicuous brown sublateral stripe, the margins broadly pale; outer three segments blackened; male hypopygium with the tergite produced into a simple spiculose lobe; outer dististyle relatively small, pale, with sparse short setæ; inner dististyle with the apex of the outer lobe obtuse, with a strong erect spine on inner margin below the apex.

Male.—Length, about 18 millimeters; wing, 21.5; antenna, about 6.2.

Anterior region of head broken. Antennæ (male) relatively long; scape and pedicel yellow, succeeding segments weakly bicolored, the basal enlargements black, the stems brown, the color of the latter becoming darker on the outer segments; segments subequal to or a trifle longer than the longest verticil. Head above dark brownish gray.

Pronotum buffy yellow. Mesonotal præscutum almost uniformly light gray, the usual stripes not or scarsely differentiated from the ground; scutal lobes similarly dark gray; scutellum destroyed in pinning; postnotum light yellow, including the pleurotergite. Pleura yellow, unpatterned. Halteres with stem brown, the knob a little darker. Legs with the coxæ grayish yellow; trochanters yellow; femora and tibiæ obscure yellow, the narrow tips dark brown; tarsi brown; passing into black; claws (male) toothed. Wings strongly tinged with brownish, the prearcular and costal regions more yellowed; stigma elongate, brown; a major whitened area before the stigma and anterior cord, extending into the base of cell M_3; veins dark brown, brownish yellow in the brightened fields, white in the obliterative area. Venation: Rs about one-third to one-fourth longer than m-cu; petiole of cell M_1 about one-half longer than m.

Basal abdominal tergites obscure yellow, with a conspicuous brown sublateral stripe, the lateral margins broadly pale; basal sternites yellow; seventh and succeeding segments blackened. Male hypopygium (Plate 2, fig. 15) with the caudal margin extended into a simple spiculose point, not bifid as in *gemma*.

Outer dististyle, *d*, much smaller than in *gemma*, appearing as a pale blade, with relatively short and scattered setæ. Inner dististyle, *d*, broken but the portion distad of the beak preserved and showing distinctive characters; apex of outer lobe expanded, subcircular or bulbous; outer portion of disk before apex with a low compressed flange; inner margin between the outer lobe and the beak produced into a strong erect spine; sensory area including rather numerous pores, at least a score in number; outer surface of style with long erect retrorse setæ. Eighth sternite scarcely sheathing, the posterior border on either side of the midline produced into a low lobe that is provided with abundant yellow setæ. This latter somewhat suggests the condition in the otherwise quite distinct *bicompressa* and *bipenicillata*.

Habitat.—Japan (Shikoku).

Holotype, male, Iwai, near Imanoyama, Tosa, altitude 200 meters, May 11, 1951 (*Issiki-Ito*).

In its general appearance, particularly in the pattern of the wings, the present fly much resembles *Tipula* (*Acutipula*) *gemma* sp. nov., which has the details of coloration and especially of the structure of the male hypopygium quite distinct, particularly the tergite, both dististyles, and the eighth sternite.

78. TIPULA (ACUTIPULA) GEMMA sp. nov. **Plate 2, fig. 14.**

General coloration gray, the præscutum with four brown stripes, the intermediate pair confluent behind; wings strongly infuscated; stigma dark brown; a major whitened area before the anterior cord; abdomen with the basal segments fulvous, the outer ones, with the hypopygium, black; male hypopygium with the ninth tergite produced into two broad spiculose lobes that are separated by a narrow notch; outer dististyle truncated at apex; inner dististyle with its outer lobe relatively slender, the apex split into two microscopic points; beak of style compressed, subtruncate and blackened apically.

Male.—Length, about 20 millimeters; wing, 22; antenna, about 4.5.

Frontal prolongation of head long, nearly equal to the remainder of head, dark gray above, brown on ventral half; nasus long; palpi brownish black. Antennæ with the scape and pedicel dark brown, basal two or three flagellar segments brown, the outer ones darker brown to brownish black; flagellar segments with basal swellings moderately developed, longest

verticils a trifle shorter than the segments. Head uniformly gray; vertex flattened, without a tubercle.

Pronotum gray, variegated with brown. Mesonotum gray, the præscutum with four brown stripes, the intermediate pair long, narrowed on anterior fourth, becoming confluent behind, their inner borders narrowly more darkened; scutal lobes less evidently darkened; posterior sclerites of notum light gray, with a vague central darkened line; katapleurotergite well-delimited, more yellowish gray. Pleura clear light gray; dorsopleural membrane buffy in front surrounding the spiracle, more infuscated elsewhere. Halteres pale brown, the knobs dark brown. Legs with the coxæ light gray; trochanters yellow; femora brownish yellow, becoming darker outwardly, the tips, involving about the distal eighth or less, dark brown to brownish black; tibiæ and tarsi brownish black; claws strongly toothed. Wings with the ground strongly infuscated, the prearcular and costal fields more brownish yellow; stigma dark brown, conspicuous; a major whitish area before the stigma and anterior cord, occupying the proximal half of cell 1st M_2 and barely invading cell M_3; no poststigmal brightening; veins black, brown in the costal and prearcular fields, still paler in the obliterative area. Venation: Rs only a little longer than m-cu; m and the petiole of cell M_1 subequal.

Abdomen with the basal four segments fulvous, the posterior borders of the tergites narrowly yellow, the lateral margins more evidently so; basal rings of the third and fourth tergites very narrowly darkened; on the fourth segment a sublateral darkening, the succeeding segments more uniformly blackened, including the hypopygium. Male hypopygium (Plate 2, fig. 14) with the shoulders of the ninth tergite, *9t*, rounded, the median area produced into two broad lobes that are separated by a narrow notch, the lobes with abundant spicules. Both the eighth and ninth sternites unarmed, the latter sloping obliquely. Outer dististyle, *d*, flattened, arcuate, widened outwardly, the apex truncate; lower angle square to slightly acute. Inner dististyle, *d*, with the outer lobe relatively slender, narrowed outwardly, the apex microscopically split into two points, with a further longer spine on the lower margin back from the tip; outer surface or crest of lobe with long conspicuous setæ; beak conspicuous, compressed, subtruncate and blackened apically. Gonapophysis, *g*, appearing as a relatively short and stout dusky blade.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Saragamine, Iyo, altitude 1,271 meters, June 2, 1951 (*Miyatake*).

The present fly is quite distinct from the other members of the subgenus in Japan, being most similar to forms such as *Tipula* (*Acutipula*) *kuzuensis* Alexander and *T.* (*A.*) *tokionis* Alexander. It differs evidently in body and wing coloration and in the structure of the male hypopygium, particularly the ninth tergite and the inner dististyle.

79. TIPULA (ARCTOTIPULA) HIRTICULA sp. nov. **Plate 2, figs. 12, 13.**

General coloration of mesonotum light gray, the præscutum with four entire dark brown stripes, the intermediate pair not reaching the anterior margin; no nasus; antennal pedicel light yellow, flagellum black; femora brownish yellow, the tips broadly blackened, tibiæ and tarsi black; wings brownish yellow, stigma oval, dark brown, conspicuous, remainder of wing weakly patterned with brown; basal abdominal segment gray, succeeding tergites brownish black, pruinose, with broad reddish yellow margins; outer segments, including the hypopygium, more uniformly blackened; male hypopygium with the ninth tergite narrowly transverse, very hairy, the median region beneath produced into a depressed sclerotized plate; inner dististyle with the posterior end of the head produced backward into an acute point.

Male.—Length, about 15 to 16 millimeters; wing, 18 to 18.5; antenna, about 4.

Frontal prolongation of head elongate, subequal in length to the remainder of head, dark gray; nasus lacking; palpi black. Antennæ of moderate length; scape brown, pedicel light yellow, flagellum black flagellar segments moderately incised, the basal enlargements conspicuous; longest verticils subequal to or slightly longer than the segments. Head dark gray with a capillary darker brown median line; vertical tubercle very low and inconspicuous.

Pronotum gray, with a small dark brown central spot. Mesonotal præscutum light gray, best indicated at the borders, with four entire dark brown stripes; intermediate pair narrowly separated by a brown vitta, connected behind, the stripes ending some distance before the cephalic margin; posterior interspaces weakly infuscated; posterior sclerites of notum gray, each scutal lobe with two confluent dark brown areas; scutellum with a barely indicated capillary brown median line; mesonotum unusually glabrous. Pleura and pleurotergite clear

light gray; dorsopleural membrane yellow. Halteres with stem yellow, knob infuscated. Legs with all coxæ clear light gray, with long pale setæ; trochanters yellow; femora brownish yellow, the tips broadly blackened; tibiæ and tarsi black; claws (male) small, simple. Wings (Plate 2, fig. 12) relatively narrow, brownish yellow, the prearcular field and costal cell more saturated yellow, cell Sc brown; stigma oval, dark brown, conspicuous; a weak brown pattern, including seams over the cord and adjacent veins, together with the broad wing tip; paler prestigmal and poststigmal areas, best indicated by the more yellowed veins; remaining veins brownish black. Macrotrichia on R_{4+5} and more sparsely on outer end of R_3, lacking elsewhere on veins beyond cord; no stigmal trichia. Venation: Rs about twice m–cu; R_{1+2} in virtual longitudinal alignment with R_2; m subequal to or longer than the petiole of cell M_1, varying in the degree of obliquity.

Basal abdominal segment gray; succeeding tergites brownish black, pruinose, with the margins broadly obscure reddish yellow; basal sternites extensively reddish yellow, vaguely patterned with darker; outer segments, including hypopygium, blackened, pruinose, the outer dististyle pale. Male hypopygium (Plate 2, fig. 13) with the tergite, *9t*, narrowly transverse, the width across the body being about five times the length; surface with abundant long black setæ; median region of posterior border produced ventrad into a depressed sclerotized, plate, the apical margin of which is toothed as figured. Basistyle, *b*, with a sclerotized plate, the cephalic part of which is microscopically spiculose or roughened. Outer dististyle, *d*, oval, about twice as long as broad, pale, with scattered retrorse setæ. Inner dististyle, *d*, about as long, narrower, appearing as a simple sinuous blade, its beak obtuse; posterior end of head produced backward into a small acute point, surrounded by a few long setæ; before the beak, in the position usually occupied by the lower beak with a small conical blackened point. Phallosome reduced.

Habitat.—Japan (Shikoku).

Holotype, male, Ojoin, near Niihama, Iyo, April 14, 1949 (*Miyatake*). Paratopotype, a teneral male.

The nearest relatives of this fly include various northern and subarctic species in the Holarctic fauna, including *Tipula* (*Arctotipula*) *besselsi* Osten Sacken, *T.* (*A.*) *salicetorum* Siebke, *T.* (*A.*) *kincaidi* Alexander, and others. There are no close allies in Japan. The structure and armature of the

ninth tergite of the male hypopygium is quite different from that of the various species above mentioned.

80. TIPULA (VESTIPLEX) SERRICAUDA Alexander.

Tipula serricauda ALEXANDER, Can. Ent. 46 (1914) 237–238, *pl. 10, fig. 4* (wing), *pl. 19, fig. 6* (ovipositor).
Tipula asio ALEXANDER, N. Y. Ent. Soc. Jour. 26 (1918) 68.
Tipula (Vestiplex) asio ALEXANDER, Philip. Jour. Sci. 57 (1935) 118.
Tipula (Vestiplex) serricauda ALEXANDER, Philip. Jour. Sci. 57 (1935) 118.

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950 (*Issiki–Ito*).

IYO: Mount Iwaya, altitude 600 meters, May 22, 1949 (*Miyatake*).

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81. LIMONIA (LIMONIA) ANTHRACINA (Alexander).

Limnobia anthracina ALEXANDER, Insec. Inscit. Menst. 10 (1922) 180–181.

TOSA: Nisigawa to Kokusen, altitude 600 meters, May 4, 1951, altitude 1,000 meters, May 3, 1951 (*Issiki-Ito*); Kokusen, near Yanase, altitude 500 meters, May 5, 1951 (*Issiki-Ito*).

82. LIMONIA (LIMONIA) EUPHILETA Alexander.

Limonia euphileta ALEXANDER, Insec. Inscit. Menst. 12 (1924) 154.
Limonia biceps ALEXANDER, Ann. and Mag. Nat. Hist. (9) 15 (1925) 386–388, *figs. 2, 3* (venation, ♂ hypopygium).
Limonia (Limonia) euphileta ALEXANDER, Philip. Jour. Sci. 51 (1933) 530–531.

AWA: Mount Tsurugi, Kawati to Minokosi, altitude 1,400 meters, May 30, 1950, Mount Tsurugi, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*); Minokosi, altitude 1,400 meters, to Nagoro, altitude 900 meters, June 1, 1950 (*Issiki-Ito*).

TOSA: Totidani, near Yanase, altitude 400 meters, May 2, 1951 (*Issiki-Ito*); Nisigawa to Kokusen, altitude 600 meters, May 4, 1951 (*Issiki-Ito*).

83. LIMONIA (LIMONIA) FUSCICEPS Alexander.

Limonia fusciceps ALEXANDER, Insec. Inscit. Menst. 12 (1924) 155–156.
Limonia (Limonia) fusciceps ALEXANDER, Philip. Jour. Sci. 51 (1933) 531, *pl. 3, fig. 34* (♂ hypopygium).

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki-Ito*).

84. **LIMONIA (LIMONIA) MACHIDAI (Alexander).**

Dicranomyia machidai ALEXANDER, Ent. Soc. America Ann. 14 (1921) 113.

Limonia (Limonia) machidai ALEXANDER, Philip. Jour. Sci. 42 (1930) 507.

Limnobia pusilla LACKSCHEWITZ, Naturhist. Mus. Wien Ann. (1928) 232–233, *pl. 6, figs. 21, a, b* (♂ hypopygium).

TOSA: Nisigawa to Kokusen, near Yanase, altitude 600 meters, May 4, 1951 (*Issiki-Ito*); Kokusen, altitude 500 meters, May 5, 1951 (*Issiki-Ito*).

A very widespread species throughout the eastern Palæarctic Region, occurring as far to the west as Austria.

85. **LIMONIA (LIMONIA) NUBECULOSA Meigen.**

Limonia nubeculosa MEIGEN, Klass. 1 (1804) 60.

Limonia (Limonia) nubeculosa EDWARDS, Soc. British Ent. Trans. 5 (1938) 25, *pl. 2, figs. 6, 7* (wing).

Limnobia sciophila OSTEN SACKEN, U. S. Geol. Surv. Bull. 3 (1877) 197.

Limnobia subnubeculosa ALEXANDER, Amer. Ent. Soc. Trans. 46 (1920) 5–6.

Limonia (Limonia) subnubeculosa ALEXANDER, Philip. Jour. Sci. 44 (1931) 340.

Limonia subnubeculosa ESAKI, et al., Icon. Insect. Japan, Ed. 2 (1950) 1515, *fig.*

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki-Ito*).

In the past, attempts have been made to separate *nubeculosa* of the western Palæarctic Region, *subnubeculosa* of the eastern Palæarctic Region, and *sciophila* of the western Nearctic Region. Over the years very abundant materials of all of these supposed species have become available and it does not now appear that they can be maintained, even subspecifically. The species *nubeculosa* as thus interpreted has an almost unbroken Holarctic distribution, being lacking only in the eastern Nearctic Region.

86. **LIMONIA (LIMONIA) PLUTONES Alexander.**

Limonia plutonis ALEXANDER, Philip. Jour. Sci. 24 (1924) 552–553.

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki-Ito*).

A male specimen, the largest that I have yet seen (length, about 14 millimeters; wing 21). The strict subgeneric position of this fly remains in question. Although the venation is as in the typical subgenus, the structure of the hypopygium is more as in *Libnotes,* wherein it may perhaps be better placed.

87. **LIMONIA (LIBNOTES) AMATRIX** Alexander.

Limnobia amatrix ALEXANDER, Insec. Inscit. Menst. 10 (1922) 181–182.

TOSA: Iwai, near Imanoyama, altitude 200 meters, May 13, 1951 (*Issiki-Ito*).

88. **LIMONIA (LIBNOTES) DIVARICATA** Alexander.

Limonia divaricata ALEXANDER, Ent. Soc. America Ann. 17 (1924) 61.

TOSA: Asizuri-misaki, May 10, 1951 (*Issiki-Ito*).

89. **LIMONIA (LIBNOTES) UNDULATA** (Matsumura).

Libnotes undulatus MATSUMURA, Thous. Ins. Japan, Addit. 2 (1916) 467–468, *pl. 25, fig. 8* (entire ♀).

IYO: Mount Saragamine, altitude 1,271 meters, July 22, 1949 (*Ishihara*).

90. **LIMONIA (DISCOBOLA) MARGARITA** (Alexander).

Discobola margarita ALEXANDER, Philip. Jour. Sci. 24 (1924) 539–540.
Limonia (*Discobola*) *margarita* ALEXANDER, Philip. Jour. Sci. 42 (1930) 508.

TOSA: Mount Imanoyama, altitude 865 meters, May 12, 1951 (*Issiki-Ito*).

Widely distributed in eastern Asia, from northern Korea, Karafuto and Hokkaido, south to Formosa.

91. **LIMONIA (RHIPIDIA) LACONTEI** Alexander, subsp.

Rhipidia maculata MEIGEN, Syst. Beschr. 1 (1818) 153, *pl. 5, fig. 11*.
Limonia (*Rhipidia*) *maculata* EDWARDS, Soc. Brit. Ent. Trans. 5 (1938) 45, *pl. 3, fig. 3* (wing).
Limonia (*Rhipidia*) *maculata lecontei* ALEXANDER, Amer. Midl. Nat. 24 (1940) 624–625.
Rhipidia maculata ESAKI, et al., Icon. Insect. Japan, Ed. 2 (1950) 1518, *fig.*

IYO: Mount Ishizuchi, Koguti, altitude 1,400 meters, June 8, 1950 (*Issiki-Ito*).

The earliest name for this species of crane-fly, *maculata* Meigen, 1818, is preoccupied by a still earlier use of the same specific name by Meigen, 1804. The oldest subspecific name that is available to replace the name *maculata* appears to be *lecontei*, as above cited. The possibility exists however that some other species in the Asiatic fauna may be found to be only subspecifically distinct and earlier and so have to replace the present combination. In this state of confusion it seems better to use the name as above given until the matter is finally settled.

This crane-fly appears to have a vast range throughout much of the Holarctic Region.

92. LIMONIA (RHIPIDIA) PULCHRA (de Meijere).

Rhipidia pulchra DE MEIJERE, Bijd. tot Dierkunde 17 (1904) 92, *pl. 8, fig. 7* (entire insect, colored).
Dicranomyia pulchra DE MEIJERE, Tijd. voor Ent. 54 (1911) 27–28, *pl. 2, figs. 14–16* (antenna, ♂ hypopygium).
Rhipidia pulchra septentrionis ALEXANDER, Can. Ent. 45 (1913) 206–207, *pl. 8, fig. 1* (wing).
Rhipidia pulchra septentrionis ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1518, *fig.*

IYO: Dogo, near Matsuyama, April 27, 1947 (*Yano*).

It no longer appears advisable to recognize the subspecies *septentrionis*.

93. LIMONIA (DICRANOMYIA) IMMODESTOIDES (Alexander).

Dicranomyia immodestoides ALEXANDER, Ent. Soc. America Ann. 12 (1919) 327–328.
Limonia (*Dicranomyia*) *immodestoides* ALEXANDER, Philip. Jour. Sci. 42 (1930) 507.
Dicranomyia iowensis ROGERS, Florida Ent. 9 (1926) 49–52, *figs.*
Limonia (*Dicranomyia*) *iowensis* ALEXANDER, Dipt. Conn. Fasc. 1 (1942) 319–320, *fig. 35, K* (♂ hypopygium).
Dicranomyia immodestoides ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1517, *fig.*

IYO: Ishii-mura, near Matsuyama, March 30, 1949 (*Yano*); Ojoin, near Niihama, April 13, 1949 (*Miyatake*).

The species is wide-spread in central and eastern Asia. It appears, moreover, that the Nearctic *iowensis* is the same species. With such a distribution, it might be expected that the fly would likewise occur in the western Palæarctic Region but this does not seem to be the case. The species in that fauna having cell M_2 of the wings open, including *aperta* Wahlgren and *patens* Lundstrom (a synonym of *brevivena* Osten Sacken), both belong to entirely distinct groups of the subgenus and are entirely different from the present fly.

94. LIMONIA (DICRANOMYIA) LONGIPENNIS (Schummel).

Limnobia longipennis SCHUMMEL, Beitr. zur Ent. (1829) 104.
Dicranomyia immenor OSTEN SACKEN, Acad. Nat. Sci. Philadelphia. Proc. (1861) 287.
Limonia (*Dicranomyia*) *longipennis* ALEXANDER, Dip. Conn. Fasc. 1 (1942) 321, *fig. 36, B* (♂ hypopygium).

TOSA: Simoka-waguti, May 10, 1951 (*Issiki-Ito*).

A male specimen, entirely typical, except that the ventral dististyle of one side shows three rostral spines, the two normal ones, with an additional spine about two-thirds as long, placed on the side of the prolongation.

The species is wide-spread throughout the entire Holarctic Region.

95. LIMONIA (DICRANOMYIA) MONOSTROMIA Tokunaga.

Limonia (*Dicranomyia*) *monostromia* TOKUNAGA, Kyoto Imp. Univ., Coll. Agr. Mem. 10 (1930) 1–93, *17 pls.*; Mushi 7 (1934) 90–96. *Dicranomyia monostromia* ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1517, *fig.*

TOSA: Simoka-waguti, May 10, 1951 (*Issiki-Ito*).

Originally described from the Kii Peninsula, Honshu. The basic paper above cited by Dean Tokunaga is one of the outstanding studies ever made on any insect.

The only near relative of the fly at present known is *Limonia* (*Dicranomyia*) *marmorata* (Osten Sacken) (*signipennis* Coquillett) which likewise has a marine larva and is very close to the present fly. Tokunaga [(1930) 58] has provided a detailed comparison of the two forms, including all four stages. The most complete paper yet published on *marmorata* is by Saunders.[2]

From the structure of the antennæ, a reference of the species to the subgenus *Idioglochina* Alexander is suggested but I am following current usage in placing the fly as is done herewith. It may be noted that the larvæ of all species of *Idioglochina*, as far as this has been determined, have a marine habit.

96. LIMONIA (DICRANOMYIA) NANKAIDŒNSIS sp. nov. Plate 3, figs. 16, 17.

Belongs to the *morio* group and subgroup; fore femora blackened except basally; wings weakly darkened, the prearcular field yellowed; stigma darker brown, preceded and followed by major whitened areas; basal abdominal segments bicolored, black, with more than the outer half yellowed, the sixth and succeeding segments uniformly black; male hypopygium with the tergite terminating in two stout lobes that are separated by a circular notch; dorsal dististyle acute at apex; ventral dististyle profoundly bifid; gonapophysis uniformly blackened, the apex obtusely rounded and slightly decurved; ædeagus relatively narrow, obtuse at tip.

Male.—Length, about 5 to 5.5 millimeters; wing, 5.8 to 6.5.

Rostrum and palpi black. Antennæ black throughout; flagellar segments long-oval, constricted into narrow paler

[2] Saunders, L. G. Ent. Soc. America Ann. 21 (1928) 521–545, *fig. 7* (details of all stages). As *signipennis* Coquillett, from the Pacific coast of North America.

basal pedicels. Head behind black, the front and anterior vertex silvery white.

Thorax polished black, the pronotum and a very broad dorsal pleural stripe silvery gray. Halteres with stem yellow, knob dark brown. Legs with the coxæ polished black, the extreme tips yellowed; trochanters yellow; fore femora black, restrictedly brightened basally, remaining femora yellow, the tips narrowly brownish black; tibæ obscure yellow, the tips narrowly and vaguely darkened; tarsi obscure yellow, the outer segments darker. Wings (Plate 3, fig. 16) weakly darkened, the prearcular field yellowed; stigma oval, darker brown, with extensive more whitened areas before and beyond it; veins brown, yellow in the prearcular field. Venation: Sc_1 long, ending opposite origin of Rs; R_2 and free tip of Sc_2 both pale, in transverse alignment; m–cu close to fork of M.

Basal abdominal segments bicolored, black, with more than the outer half yellow; on the fifth segment the amount of the two colors is equal; sixth and succeeding segments, including hypopygium, black. Male hypopygium (Plate 3, fig. 17) with the tergite, *9t*, broad, narrowed outwardly, terminating in two stout lobes that are separated by a circular notch. Ventromesal lobe of basistyle, *b*, small. Dorsal dististyle, *dd*, acute at apex. Ventral dististyle, *vd*, profoundly bifid, the lower arm longest, a little dilated at outer end, without a rostral spine. Gonapophysis, *g*, uniformly blackened, the apex rounded and slightly decurved. Ædeagus, *a*, relatively narrow, obtuse at tip.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki-Ito*). Paratopotypes, 2 males, one pinned with type; paratype, male, Nisigawa, near Yanase, Tosa, altitude 800 meters, May 3, 1951 (*Issiki–Ito*).

This is the first member of the *morio* subgroup to be found in eastern Asia, although rather numerous species occur in Europe and fewer in North America. Among the European species, the present fly is most similar to *Limonia* (*Dicranomyia*) *caledonica* Edwards, which has the abdomen uniformly blackened, and with the details of the male hypopygium distinct, particularly the ventromesal lobe of the basistyle, gonapophyses and ædeagus.

97. **LIMONIA (DICRANOMYIA) POLI** Alexander.

Limonia (*Dicranomyia*) *fullowayi* ALEXANDER, Philip. Jour. Sci. 63 (1937) 373; nec *fullowayi* ALEXANDER, Can. Ent. 47 (1915) 79–80.

Limonia (*Dicranomyia*) *fullowayi* ALEXANDER, Notes d'Ent. Chinoise (5) 4 (1937) 70.

Limonia (*Dicranomyia*) *poli* ALEXANDER, Philip. Jour. Sci. 76 (1941) 44, *pl. 1, fig. 11* (venation), *pl. 3, fig. 35* (♂ hypopygium).

IYO: Matsuyama, November 3, 1951 (*Yano*).

Widespread in eastern Asia, as far west as Szechwan, China.

98. **LIMONIA (DICRANOMYIA) PSEUDOMORIO (Alexander).**

Dicranomyia pseudomorio ALEXANDER, Amer. Ent. Soc. Trans. 46 (1920) 3–4.

Limonia (Dicranomyia) pseudomorio ALEXANDER, Philip. Jour. Sci. 51 (1933) 370.

IYO: Mount Ishizuchi, altitude 1,200 meters, August 10, 1925 (*Harukawa*).

99. **LIMONIA (DICRANOMYIA) TAKEUCHII (Alexander).**

Dicranomyia takeuchii ALEXANDER, Insec. Inscit. Menst. 10 (1922) 179–180.

Dicranomyia takeuchii ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1516, *fig.*

IYO: Mount Ishizuchi, altitude 1,400 meters, to Koguti, altitude 300 meters, June 11, 1950 (*Issiki–Ito*).

100. **LIMONIA (GERANOMYIA) AVOCETTA (Alexander).**

Geranomyia avocetta ALEXANDER, Can. Ent. 45 (1913) 205–206, *pl. 3, fig. 8* (wing), *pl. 4, figs. 5–7* (♂ hypopygium).

IYO: Sugitate, November 1, 1951 (*Ishihara*).

101. **LIMONIA (THRYPTICOMYIA) UNISETOSA Alexander.**

Thrypticomyia arcuata ALEXANDER, Amer. Ent. Soc. Trans. 46 (1920) 4; preoccupied by *Limonia* (*Peripheroptera*) *arcuata* ALEXANDER, Ent. News 24 (1913) 411–412.

Limonia (*Thrypticomyia*) *unisetosa* ALEXANDER, Philip. Jour. Sci. 40 (1929) 248.

IYO: Dogo, near Matsuyama, October 14, 1947 (*Yano*).

102. **HELIUS (HELIUS) TENUIROSTRIS Alexander.**

Helius (*Helius*) *tenuirostris* ALEXANDER, Philip. Jour. Sci. 24 (1924) 560–561.

Helius tenuirostris ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1519, *fig.*

IYO: Mount Ishizuchi, altitude 1,000 meters, August 10, 1925 (*Harukawa*).

TOSA: Iwai, near Imanoyama, altitude 200 meters, May 11, 1951 (*Issiki–Ito*).

103. **ELLIPTERA ZIPANGUENSIS Alexander.**

Elliptera zipanguensis ALEXANDER, Philip. Jour. Sci. 24 (1924) 559–560.

TOSA: Iwai, near Imanoyama, altitude 200 meters, May 11, 1951 (*Issiki–Ito*).

Widely distributed over the Japanese islands, with a poorly differentiated geographical race in the mountains of Formosa.

104. ANTOCHA (ANTOCHA) BIFIDA Alexander.

Antocha (Antocha) bifida ALEXANDER, Philip. Jour. Sci. 24 (1924) 564–566, *pl. 2, fig. 10* (♂ hypopygium).

TOSA: Nisigawa to Kokusen, near Yanase, altitude 600 meters, May 4, 1951 (*Issiki–Ito*) : Iwai, near Imanoyama, altitude 200 meters, May 11, 1951 (*Issiki-Ito*).

This is one of the most widely distributed of all known members of the genus, occurring from northern Korea through the main Japanese islands to Formosa, thence westward to Szechwan, western China.

105. ANTOCHA (ANTOCHA) DILATATA Alexander.

Antocha (Antocha) dilatata ALEXANDER, Philip. Jour. Sci. 24 (1924) 566–567, *pl. 2, fig. 14* (♂ hypopygium).

TOSA: Iwai, near Imanoyama, altitude 200 meters, May 11, 1951 (*Issiki–Ito*).

106. ANTOCHA (ANTOCHA) SATSUMA Alexander.

Antocha (Antocha) satsuma ALEXANDER, Ent. Soc. America Ann. 12 (1919) 332.

Antocha Satsuma ESAKI, et al., Icon Insect. Japon, Ed. 2 (1950) 1519, *fig.*

IYO: Iwazeki, near Matsuyama, March 9, 1949 (*Yano*).

107. ANTOCHA (ANTOCHA) SUBCONFLUENTA Alexander.

Antocha (Antocha) subconfluenta ALEXANDER, Philip. Jour. Sci. 42 (1930) 516–517, *pl. 1, fig. 6* (venation), *pl. 2, fig. 25* (♂ hypopygium).

TOSA: Nisigawa to Kokusen, near Yanase, altitude 600 meters, May 4, 1951 (*Issiki–Ito*).

The distinctly subterminal dististyles of the male hypopygium should be noted.

HEXATOMINI

108. AUSTROLIMNOPHILA KIRISHIMENSIS (Alexander).

Limnophila kirishimensis ALEXANDER, Ent. Soc. America Ann. 17 (1924) 438–439.

IYO: Sugitate, November 1, 1951 (*Ishihara*).

109. EPIPHRAGMA (EPIPHRAGMA) EVANESCENS Alexander.

Epiphragma (Epiphragma) evanescens ALEXANDER, Lingnan Sci. Jour. 19 (1940) 130–131, *fig. 6* (venation).

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki–Ito*); Omogokei, July 21, 1949 (*Miyatake*).

The type was from Chekiang, eastern China; a paratype from Wakayama, Honshu, Japan.

110. **EPIPHRAGMA (EPIPHRAGMA) SUBFASCIPENNIS Alexander.**

Epiphragma subfascipennis ALEXANDER, Amer. Ent. Soc. Trans. 46 (1920) 10–11.

Epiphragma subfascipennis ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1522, *fig.*

AWA: Mount Tsurugi, Minokosi, altitude 1,400 meters, to Nagoro, altitude 900 meters, June 10, 1950 (*Issiki-Ito*).

IYO: Mount Ishizuchi, altitude 1,400 meters, June 1, 1950 (*Issiki–Ito*).

111. **EPIPHRAGMA (EPIPRAGMA) SUBINSIGNIS Alexander.**

Epiphragma subinsignis ALEXANDER, Amer. Ent. Soc. Trans. 46 (1920) 11–12.

Epiphragma subinsignis ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1522, *fig.*

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki–Ito*).

112. **PSEUDOLIMNOPHILA INCONCUSSA Alexander.**

Limnophila inconcussa ALEXANDER, Can. Ent. 45 (1913) 313–314, *pl. 4, fig. 2* (wing), *pl. 10, fig. 12* (♂ hypopygium).

Pseudolimnophila inconcussa ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1522, *fig.*

IYO: Dogo, Matsuyama, April 19, 1947 (*Yano*); Matsuyama, at light trap, October 11, 1948 (*Ishihara–Miyatake*).

TOSA: Iwai, near Imanoyama, altitude 200 meters, May 11, 1951 (*Issiki–Ito*).

113. **LIMNOPHILA (PRIONOLABIS) AURIBASIS Alexander.**

Limnophila (Prionolabis) auribasis ALEXANDER, Ent. Mag. (Kyoto) 3 (1919) 126.

Limnophila (Prionolabis) auribasis ALEXANDER, Ent. Soc. America Ann. 11 (1918) 446.

Limnophila auribasis ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1524, *fig.*

IYO: Misaka-toge, altitude 716 meters, May 3, 1951 (*Yano*); Mount Saragamine, altitude 1,271 meters, May 8, 1949 (*Miyatake*).

TOSA: Nisigawa to Yanase, altitude 600 to 800 meters, May 3 to 4, 1950 (*Issiki-Ito*).

114. LIMNOPHILA (PRINOLABIS) ODAI Alexander.

Limnophila (Prionolabis) odai ALEXANDER, Philip. Jour. Sci. 51 (1933) 400–401, *pl. 1, fig. 20* (venation), *pl. 4, fig. 50* (♂ hypopygium).

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki-Ito*).

The male hypopygium was not fully described at the time of definition of the species. Median region of tergite produced, the margin weakly trilobed, the median lobe a trifle larger; surface of the produced part microscopically roughened. Inner dististyle with two major spines and, in cases, a still smaller outer one.

115. LIMNOPHILA (PRIONOLABIS) SUBMUNDA Alexander.

Limnophila (Prionolabis) submunda ALEXANDER, Ent. Mag. (Kyoto) 3 (1919) 125–126.

Limnophila (Prionolabis) submunda ALEXANDER, Ent. Soc. America Ann. 11 (1918) 446.

AWA: Mount Tsurugi, Kawati and Nagaro to Minokosi, altitude 900 meters to 1,400 meters, May 30 to June 1, 1950; altitude 1,400 to 1,955 meters, May 31, 1950 (*Issiki–Ito*).

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1900 (*Issiki-Ito*).

116. LIMNOPHILA (LIMNOPHILA) JAPONICA Alexander.

Limnophila (*Pœcilostola*) *japonica* ALEXANDER, Can. Ent. 45 (1913) 316–317, *pl. 3, fig. 2* (wing), *pl. 10, fig. 10* (♂ hypopygium).

Limnophila japonica ESAKI, et al., Icon. Insect. Japon, Ed. 2 (1950) 1523, *fig.*

IYO: Ojoin, near Niihama, April 14, 1949 (*Miyatake*).

117. LIMNOPHILA (DICRANOPHRAGMA) MICROSPILA sp. nov. Plate 3, figs. 18, 19.

General coloration of mesonotum brownish gray, the præscutum with three stripes that are separated by delicate brown lines of the interspaces; halteres and legs yellow; wings whitish subhyaline, abundantly dotted and spotted with brown in all cells; wings narrower than in the corresponding sex of taiwanensis; abdomen dark brown; male hypopygium with the outer dististyle unequally bidentate at apex; gonapophysis with the apical blade conspicuously dilated on the inner or mesal margin.

Male.—Length, about 6 to 6.5 millimeters; wing, 7 to 7.1; antenna, about 1.2.

Female.—Length, about 8 millimeters; wing, 7.5.

Rostrum and palpi brownish black. Antennæ with the scape and pedicel dark brown, proximal two or three flagellar segments yellowed, the remainder brown; segments long-subcylin-

drical, a little shorter than the longest verticils. Head dark brown, sparsely pruinose.

Pronotum brown. Mesonotum brownish gray, including three præscutal stripes that are separated by three delicate brown lines of the interspaces, lateral borders more broadly brown; pseudosutural foveæ and tuberculate pits black; posterior sclerites of notum brownish gray, the caudal part of the mediotergite more darkened. Pleura dark gray, variegated by dark brown spots to form broken longitudinal lines, with a larger area on the ventral sternopleurite. Halteres uniformly pale yellow. Legs with the coxæ brownish yellow, the tips darker; trochanters yellow; remainder of legs yellow, the outer tarsal segments brown. Wings (Plate 3, fig. 18) whitish subhyaline, with an abundant dotted and spotted brown pattern in all cells, the major areas relatively small, located at origin of Rs, along cord, stigma and as a more or less distinct concentration at and near the supernumerary crossvein; all other cells with several dots, separated or slightly confluent, including many in cell M; prearcular field light yellow; veins pale, a trifle darker in the patterned areas. Wings markedly narrower than in the corresponding sex of taiwanensis. Venation R_{1+2} only a trifle longer than R_2; supernumerary crossvein in cell R_3 about twice its own length from tip; cell 1st M_2 small, short-rectangular, with m-cu at or just before midlength; cell M_1 longer than its petiole.

Abdomen dark brown, the hypopygium somewhat brightened, especially the proximal halves of the basistyles. Male hypopygium (Plate 3, fig. 19) with the outer dististyle, *d*, slender, unequally bidentate at tip, the outer spine more slender; inner dististyle narrowed and darkened at apex, at base on outer face with a concentration of setæ. Phallosome complex, appearing about as shown. Gonapophysis, *g*, with the apical blade conspicuously dilated on its inner or mesal margin.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Ishizuchi, Koguti, Iyo, altitude 1,400 meters, June 8, 1950 (*Issiki-Ito*). Allotype, female, Mount Tsurugi, Awa, Minokosi, altitude 1,400 meters, to Nagoro, altitude 900 meters, June 1, 1950 (*Issiki-Ito*). Paratype, male, Mount Tsurugi, Sugeoi, June 4, 1950 (*Issiki-Ito*).

In its abundantly dotted and spotted wings, the present fly is closest to *Limnophila* (*Dicranophragma*) *taiwanensis* Alexander, which differs in details of coloration and in the broader wings. Of the species occurring on the main Japanese islands,

it is closest to *L.* (*D.*) *upsilon* Alexander, which has a very weak dotting in the cells of the wing but is quite distinct, with cell M faintly and evenly washed with brown, and in other characters.

118. LIMNOPHILA (ELÆOPHILA) DIETZIANA Alexander.

Limnophila (*Ephelia*) *dietziana* ALEXANDER, Ent. Soc. America Ann. 17 (1924) 437–438.

TOSA: Iwai, near Imanoyama, altitude 200 meters, May 11, 1951 (*Issiki-Ito*).

119. LIMNOPHILA (ELÆOPHILA) SUBAPRILINA Alexander.

Limnophila (*Ephelia*) *subaprilina* ALEXANDER, Ent. Soc. America Ann. 12 (1919) 340–341.

IYO: Iwazeki, near Matsuyama, April 29, 1949 (*Yano*).

120. LIMNOPHILA SUBNEMORALIS Alexander.

Limnophila subnemoralis ALEXANDER, Ann. and Mag. Nat. Hist. (9) 15 (1925) 73.

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki-Ito*).

121. PILARIA TOKIONIS MELANOTA Alexander.

Limnophila (*Eulimnophila*) *tokionis* ALEXANDER, Amer. Ent. Soc. Trans. 46 (1920) 13.

Pilaria melanota ALEXANDER, Insec. Inscit. Menst. 10 (1922) 185.

AWA: Mount Tsurugi, Sugeoi, June 4, 1950 (*Issiki-Ito*).

IYO: Mount Ishizuchi, altitude 1,400 to 1,981 meters, June 9, 1950 (*Issiki-Ito*).

It now appears that the fly with intensely blackened mesonotum (*melanota*) is at most subspecifically distinct from *tokionis* which has the mesonotum reddish brown.

122. HEXATOMA (ERIOCERA) CERBERUS sp. nov. **Plate 3, fig. 20.**

General coloration of body, including palpi, antennæ and halteres, intense black; legs black, the subbasal portions of femora vaguely brightened, the extreme base black; wings with a strong blackish tinge, vaguely patterned with still darker; macrotrichia of veins beyond cord very sparse to lacking, most persistent on distal section of vein R_5.

Male.—Length, about 14 millimeters; wing, 12; antenna, about 4.2.

Rostrum and palpi black. Antennæ (male) 7-segmented, relatively long, black throughout; first flagellar segment longer and stouter; two, three, and four subequal, last segment shortest; segments elongate-cylindrical, with dense setæ. Head velvety

black; vertical tubercle moderately conspicuous, somewhat compressed in front.

Thorax intensely black, the scutellum with a golden brown pollen, visible only when viewed obliquely from in front. Halteres short, black. Legs black, the subbasal portions of femora vaguely brightened, most evident and more extensive on the fore legs, the actual bases very narrowly black. Wings (Plate 3, fig. 20) with a strong blackish tinge, the prearcular and coastal regions, together with the small stigma, still darker; slightly darker clouds at origin of Rs and over the cord; veins Cu and second A seamed with darker; veins brown. Macrotrichia, of veins beyond cord very sparse to lacking, most persistent on distal section of vein R_5. Venation: Sc_1 ending about opposite one-third to one-fourth the length of R_{2+3}, Sc_2 opposite the fork of R_{2+3+4}; R_{2+3} and R_3 subequal; R_{2+3+4} suberect shorter than basal section of R_5; cell M_1 lacking; m-cu about two-thirds its length beyond fork of M.

Abdomen, including hypopygium, intensely black, the surface dull.

Habitat.—Japan (Shikoku).

Holotype, male, Omogokei, Iyo, July 17, 1950 (*Ishihara*).

The most similar species in the Japanese fauna include *Hexatoma* (*Eriocera*) *fulvibasis* Alexander, *H.* (*E.*) *kamiyai* Alexander, and *H.* (*E.*) *kariyai* Alexander, all of which differ in the coloration of the body, legs and wings, and in details of structure and venation. The present fly is the darkest colored of the various species of *Eriocera* so far recorded from the main Japanese islands.

123. HEXATOMA (ERIOCERA) GIFUENSIS Alexander.

Hexatoma (*Eriocera*) *gifuensis* ALEXANDER, Philip. Jour. Sci. 52 (1933) 153–155, *pl. 1, fig. 15* (venation), *pl. 2, fig. 33* (♂ hypopygium).

IYO: Matsuyama, September 14, 1947 (*Ishihara*).

The types, from Gifu, Honshu, were preserved in alcohol, causing some discoloration. Supplementary data are provided to cover certain points.

Head brownish yellow, including the large globular vertical tubercle, the summit of the latter darker brown. Mesonotum chiefly brownish gray, patterned with darker brown, including four præscutal stripes, the intermediate pair separated by a capillary line that is less distinct than the sublateral interspaces; centers of scutal lobes blackened. Mesonotum, espe-

cially the præscutum, with dense long pale setæ. Femora and tibiæ narrowly but distinctly darkened at tips. Wings with a weak spur on r-m, jutting basad into cell R; m-cu a short distance beyond the fork of M. Abdomen yellow, the posterior borders of the second and succeeding tergites narrowly infuscated, the amount increasing on the outer segments, the small hypopygium and the preceding segment uniformly dark brown.

124. HEXATOMA (ERIOCERA) IMPERATOR sp. nov. **Plate 3, fig. 21.**

Size large (wing, male, over 16 millimeters); general coloration black; antennæ (male) very long, approximately twice the wing or body; legs black, the femoral bases broadly yellow; wings with a strong dusky suffusion, the prearcular field yellowed; cell M_1 present.

Male.—Length, about 15 to 17 millimeters; wing, 17 to 18; antenna, about 33 to 35.

Rostrum brownish black; palpi black. Antennæ (male) brownish black throughout, very long, as shown by the measurements, being approximately twice the wing or body; emergence spines of the more proximal segments unusually long and delicate, on the outer segments passing into normal setæ. Head brownish black; vertical tubercle relatively large and bulbous; head with very long and abundant erect dark setæ.

Thorax almost uniformly brownish black, the præscutum with abundant erect dark setæ, those of the posterior sclerites shorter, on the postnotum and pleura sparse to virtually lacking. Halteres dark brown, the knobs still darker, base of stem very narrowly brightened. Legs with the coxæ brownish black, with conspicuous setæ; trochanters brownish black; remainder of legs black, the femoral bases yellow, on the posterior legs including nearly the basal third. Wings (Plate 3, fig. 21) with a strong dusky suffusion, the stigma a trifle darker but inconspicous; prearcular field short, conspicuously yellowed, including the veins; remaining veins a little darker than the ground. Sparse short macrotrichia on outer radial veins, even fewer on veins M_1, M_2 and distal section of M_3. Venation: R_{2+3+4} variable, from a little less than R_{2+3} to about one-half as long; cell M_1 present, subequal to or a little shorter than its petiole; m-cu from one-third to two-thirds its length beyond the fork of M.

Abdomen black, including hypopygium.

Habitat.—Japan (Shikoku).

Holotype, male, Odamiyama, Iyo, July 27, 1948 (*Hirohisa Hagimori*).

Paratype, male, Omogokei, Iyo, July 25, 1951 (*Miyatake*).

Hexatoma (*Eriocera*) *imperator* is quite distinct from the other regional species that have cell M_1 of the wings preserved and with the antennæ of the male greatly lengthened, including *H.* (*E.*) *stricklandi* (Edwards). The general black color and pattern of the legs and wings readily separate the fly from these allied species.

ERIOPTERINI

125. LIPSOTHRIX LEUCOPEZA sp. nov. **Plate 3, fig. 22.**

General coloration of mesonotum light brown to darker brown, without pattern, the pleura paler; antennæ short; femora dirty white, the tibiæ and tarsi snowy white; wings with a weak brown tinge, unpatterned; basal section of R_5 only a little shorter than R_{2+3+4}; cell 1st M_2 large, subequal to distal section of vein M_3 or longer; m-cu close to fork of M.

Male.—Length, about 6 millimeters; wing, 6.5.

Female.—Length, about 6.5 millimeters; wing, 6.5.

Rostrum and palpi yellow. Antennæ short, brown; flagellar segments oval, much shorter than the verticils. Head brown.

Thoracic dorsum almost uniformly light brown or testaceous brown, the pleura and pleurotergite more testaceous yellow. In the female, the general coloration of the thorax is darker brown. Halteres whitened, the knobs a little infuscated. Legs with the coxæ and trochanters yellow; femora dirty white, the tips clearer white; tibiæ and tarsi snowy white. Wings (Plate 3, fig. 22) with a weak brownish tinge, entirely unpatterned; veins pale brown. Venation: Sc_1 ending a short distance beyond fork of Rs, Sc_2 near its tip; R_{1+2} and R_2 subequal; basal section of R_5 only a little shorter than R_{2+3+4}; cell first M_2 large, in male subequal to the distal section of M_{1+2}, somewhat shorter in female; m-cu at or just before or beyond the fork of M; cell second A moderately broad.

Abdomen of male brownish yellow, the subterminal sternites darker, hypopygium yellow. In female, abdomen such darker brown; hypovalvæ relatively slender, much longer than the gently upcurved cerci.

Habitat.—Japan (Shikoku).

Holotype, male, Totidani, near Yanase, Tosa, altitude 400 meters, May 2, 1951 (*Issiki-Ito*). Allotopotype, female, pinned with type.

The most similar species in *Lipsothrix taiwanica* Alexander, which differs in the coloration of the legs and in the venation, especially of the radial and outer medial fields.

126. GONOMYIA (IDIOCERA) SHANTUNGENSIS Alexander.

Gonomyia (*Ptilostena*) *shantungensis* ALEXANDER, Philip. Jour. Sci. 42 (1930) 77–78, *pl. 2, fig. 32* (♂ hypopygium).

IYO: Dogo, Matsuyama, April 20, 1947, October 3, 1947 (*Yano*).

Genus ERIOPTERA Meigin

HOPLOERIOPTERA Subgen. nov.

Rostrum short. Antennæ 16-segmented; no fusion of segments; flagellar segments with very long verticils. Legs with long simple setæ only; no tibial spurs; claws long and slender, virtually straight. Pot-bellied condition of the meron less developed than in typical *Erioptera*. Wings with Sc_2 evidently lacking; Rs relatively short, a little less than vein R_3; cell 1st M_2 closed; m-cu about two-thirds to fully its own its length beyond the fork of M; vein 2nd A virtually straight, with a slight outer sinuosity. Long abundant trichia on veins. Male hypopygium with two terminal dististyles. Ædeagus long and slender, the tip decurved, simple. Gonapophyses appearing as slender curved spines. Tergal plate undeveloped.

Type of subgenus.—Erioptera (*Hoplœrioptera*) *shikokuensis* sp. nov. (Eastern Palæarctic Region). *Erioptera* (*Hoplœrioptera*) *luctuosipes* sp. nov., likewise belongs here.

I am placing this group as a subgenus under *Erioptera* Meigen, though with some doubt and it may well be found to represent a valid genus. In some respects it suggests *Gnophomyia* Osten Sacken but I believe that the association with *Erioptera* is more nearly correct.

127. ERIOPTERA (HORPLŒRIOPTERA) SHIKOKUENSIS sp. nov. Plate 4, figs. 23, 24.

General coloration pale yellow; legs brownish yellow; wings pale yellow, cell 1st M_2 closed; male hypopygium with two dististyles, the outer a long flattened ribbonlike blade with a short black spine at base, the inner style shorter, terminating in two strong spines; gonapophyses appearing as two simple curved black spines; ædeagus long and slender, its tip decurved.

Male.—Length, about 4.5 to 5 millimeters; wing, 5.5 to 6; antenna, about 0.9 to 1.0.

Female.—Length, about 5.5 millimeters; wing, 6.

Rostrum brownish yellow; palpi a little darker. Antennæ yellowish brown; flagellar segments subcylindrical, with very long conspicuous verticils that exceed the segments. Head yellow; anterior vertex broad.

Thorax uniformly pale yellow. Halteres short, pale yellow throughout. Legs with the coxæ and trochanters pale yellow;

remainder of legs more brownish yellow, this color more obscured by abundant dark trichia. Wings (Plate 4, fig. 23) pale yellow, a trifle more saturated at base; veins yellowish brown. Venation: As described under the subgenus; Sc long, Sc_1 ending nearly opposite R_2; R_{2+3} about one-third R_{2+3+4}; m shorter than basal section of M_3.

Abdomen, including hypopygium, yellow. Male hypopygium (Plate 4, fig. 24) with the outer dististyle, *d*, a long flattened ribbonlike blade, the tip obtuse, near base on outer margin with a curved black spine. Inner dististyle, *d*, about one-half as long, at apex with two strong spines, one a trifle more curved than the other; apex of stem of style produced slightly beyond the level of the spines as a conical point. Gonapophysis, *g*, appearing as a simple curved black spine. Ædeagus, *a*, long and slender, slightly dilated beyond midlength, the simple apex decurved.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, Minokosi, altitude 1,400 meters, to Nagoro, 900 meters, June 1, 1950 (*Issiki-Ito*). Allotopotype, female, pinned with type. Paratopotypes, 6 males and females, with the types.

The only close relative is the species next described as *Erioptera* (*Hoplœrioptera*) *luctuosipes* sp. nov., where the two species are compared. Superficially the present fly suggests species of *Erioptera* (*Psiloconopa*), such as *E.* (*P.*) *sachalina* Alexander, *E.* (*P.*) *subareolata* Alexander, and *E.* (*P.*) *yezoana* Alexander, differing in the subgeneric characters.

128. ERIOPTERA (HOPLŒRIOPTERA) LUCTUOSIPES sp. nov. **Plate 4, figs. 25, 26.**

General coloration whitish yellow, the præscutum with four more reddish stripes; legs with the coxæ and trochanters yellow, the remainder abruptly brownish black to black; wings tinged with yellow, the prearcular and costal fields paler yellow; male hypopygium with the outer dististyle a long simple darkened blade; inner dististyle narrowed outwardly, terminating in a long straight spine, with a second smaller spine on the face at near midlength; gonapophysis strongly curved into a long spine; with a small point on outer margin at near two-thirds the length; ædeagus relatively short, conspicuously flanged except on the short apex.

Male.—Length, about 5 to 5.5 millimeters; wing 6 to 6.5.

Female.—Length, about 5.5 to 6 millimeters; wing 6.5 to 7.

Rostrum obscure yellow; palpi black. Antennæ black, the scape paler; flagellar segments long-oval to subcylindrical, the longest verticils nearly twice the segments. Head yellow.

Thorax chiefly whitish yellow, the præscutum with four more reddish stripes, the centers of the cutal lobes of this same color. Halteres yellow. Legs with the coxæ and trochanters yellow; remainder of legs abruptly brownish black to black. Wings (Plate 4, fig. 25) tinged with yellow, the prearcular and costal fields paler yellow; veins beyond cord brown, the remaining veins more yellowed. Venation: R_2 varying from subequal to R_{2+3} to twice this length.

Abdomen brownish yellow; hypopygium light yellow. Male hypopygium (Plate 4, fig. 26) with the outer dististyle, *d*, a long simple darkened blade, the apex obtuse, with no basal spine; inner dististyle narrowed outwardly, terminating in a long straight black spine, with a second smaller spine on the face at near midlength. Gonapophysis, *g*, black, strongly curved, narrowed into a long spine, on outer margin at near two-thirds the length with a small point. Ædeagus, *a*, relatively short, subtended by a broad flange, the free apex short.

Habitat.—Japan (Shikoku).

Holotype, male, Nisigawa to Yanase, Tosa, altitude 600 meters, May 4, 1951 (*Issiki-Ito*). Allotopotype, female, pinned with type. Paratopotypes, 5 of both sexes; paratypes. Kokusen near Yanase, Tosa, altitude 500 meters, May 5, 1951 (*Issiki-Ito*).

This crane-fly is readily told from the subgenotype, *Erioptera* (*Hopolœrioptera*) *shikokuensis* sp. nov., by the blackened legs, and especially in the details of structure of the male hypopygium, including both dististyles, the gonapophyses, and the ædeagus.

129. ORMOSIA (ORMOSIA) ATRIPES Alexander.

Ormosia atripes ALEXANDER, Ent. Soc. America Ann. 12 (1919) 335.

TOSA: Nisigawa to Yanase, altitude 600 meters, May 4, 1951 (*Issiki-Ito.*)

130. MOLOPHILUS (MOLOPHILUS) ALBOHALTERATUS Alexander.

Molophilus (*Molophilus*) *albohalteratus* ALEXANDER, Ent. Soc. America Ann. 17 (1924) 435.

IYO: Misaka-toge, altitude 716 meters, May 3, 1951 (*Yano*).

131. MOLOPHILUS (MOLOPHILUS) DAIMIO sp. nov. **Plate 4, fig. 27.**

Belongs to the *gracilis* group and subgroup; general coloration polished black, the head above light silvery gray; antennæ (male) relatively long, nearly half the length of the body, the flagellar segments long, with conspicuous outspreading setæ

additional to the shorter verticils; knobs of halteres whitened; fore femora yellow, the outer half black, the remaining femora yellow, tips narrowly blackened, tibiæ yellow basally, the tips weakly darkened; wings with a strong blackish suffusion, the prearcular field yellow; costal border at near midlength of wing yellow, the color extended backward into cell R_1; male hypopygium with two dististyles, the outer a powerful club or blade, its outer margin coarsely toothed; inner dististyle small, at apex suddenly narrowed into a curved point.

Male.—Length, about 4 to 4.3 millimeters; wing, 4.6 to 5; antenna, about 2.

Female.—Length, about 5 millimeters, wing, 5.

Rostrum and palpi black. Antennæ (male) relatively long, as shown by the measurements; scape black, pedicel brown, flagellum pale brown, more darkened outwardly; segments long-fusiform with truncated ends, longer than the unilaterally distributed verticils; in addition to the latter, the segmenst with even longer erect pale setæ. In female, antennæ shorter but still elongate. Head above light silvery gray, darker on the sides.

Thorax uniformly polished black. Halteres with stem dusky, the knob whitened. Legs with the fore coxæ dark brown, the remaining coxæ, with the trochanters, yellow; fore femora yellow on nearly the proximal half, the remainder black; remaining femora yellow, the tips narrowly and abruptly brownish black, narrowest on the middle pair; fore tibiæ brown, darkest at tips, the proximal third yellowed, remaining tibiæ brownish yellow, the tips weakly darkened; tarsi brownish black. Wings with a strong blackish suffusion, the prearcular field yellow; costal border at near midlength paler yellow, expanded backward into cell R_1 above Rs; veins and macrotrichia dark brown, those at base yellowed. Venation: R_2 in approximate transverse alignment with r-m; petiole of cell M_3 about three times the short m-cu; vein 2nd A relatively long, ending about opposite m-cu.

Abdomen, with the male hypopygium black. Ovipositor with the valves horn-yellow. Male hypopygium (Plate 4, fig. 27) with the basistyle, *b*, produced into a long slender dorsal lobe, *db*, provided with setæ; a short stout setiferous mesal lobe, *mb*, and a very broad and low ventral lobe, *vb*, with blackened and thickened borders. Two dististyles, *d*, the outer a powerful blackened club or blade, narrowed at base, dilated outwardly, the outer margin with about six strong teeth, additional to the

outer lateral apical point, with a few smaller denticles lying more basad; inner dististyle much smaller, appearing as a dark blade, narrowed outwardly, suddenly narrowed into a weak apical spine; before the apex with a few microscopic setulæ. Phallosomic plate narrow, glabrous except for scattered setulæ at apex. Ædeagus relatively short, less than twice the phallosomic plate.

Habitat.—Japan (Shikoku).

Holotype, male, Imanoyama, Tosa, altitude 800 meters, May 12, 1951 (*Issiki-Ito*). Allotopotype, female, pinned with the type. Paratopotypes, males and females; paratypes, males and females, Kokusen, near Yanase, Tosa, altitude 500 meters, May 5, 1951 (*Issiki-Ito*).

From other generally similar polished black species, including *Molophilus* (*Molophilus*) *nocticolor* sp. nov., and *M.* (*M.*) *takaoensis* Alexander, the present fly is well-distinguished by the long antennæ, pattern of the head, legs and wings and especially by the structure of the male hypopygium.

132. MOLOPHILUS (MOLOPHILUS) IYOANUS sp. nov. **Plate 4, fig. 28.**

Belongs to the *gracilis* group and subgroup; general coloration brown; antennæ short; legs dark brown; wings narrow, weakly tinged with brown; male hypopygium with the dorsal lobe of basistyle produced into an acute spine; mesal lobe large, without major setæ; ventral lobe a stout setiferous club; both dististyle small, pale, the outer triangular, narrowed to the terminal spine; inner style produced into a curved spine.

Male.—Length, about 2.8 to 3 millimeters; wing, 3.7 to 3.8; antenna, about 0.75.

Rostrum and palpi black brown. Antennæ short, dark brown; flagellar segments oval, much shorter than the long coarse verticilis. Head light brown medially, more yellowed adjoining the eyes.

Pronotum brownish yellow; pretergites light yellow. Mesonotal præscutum chestnut brown, the lateral borders a little paler, humeral region yellow; posterior sclerites of notum pale brown to yellowish brown. Pleura obscure brownish yellow, darker dorsally. Halteres infuscated, the stem more yellowed basally. Legs with the coxæ and trochanters obscure yellow, remainder of legs dark brown; fore tibia with a slightly enlarged and darker basal ring. Wings narrow with a weak brownish tinge, the prearcular and costal fields a trifle more yellowed; veins and macrotrichia brown. Venation: R_2 variable, lying approximately opposite to slightly before or beyond the level

of r-m; petiole of cell M_3 a little less than three times m-cu; vein 2nd A long and sinuous, ending before the level of posterior end of m-cu.

Abdominal tergites dark brown, sternites and hypopygium more yellowed. Male hypopygium (Plate 4, fig. 28) with the dorsal lobe, *db*, of the basistyle modified into an acute spinous point; mesal lobe large and flattened, without modified setæ; ventral lobe, *vb*, a short stout club, with conspicuous setæ. Both dististyles, *d*, small, placed far distad; outer style a pale elongate-triangular structure, its tip acute; inner style longer, the apex long, curved to an acute point. Phallosomic plate, *p*, oval, glabrous. Ædeagus long and slender, a trifle dilated just before the apex.

Habitat.—Japan (Shikoku).

Holotype, male, Okadamura, Iyo, October 2, 1949 (*Yano*). Paratopotype, male.

Molophilus (*Molophilus*) *iyoanus* is quite distinct from all other regional members of the group, being most similar to species such as *M.* (*M.*) *pegasus* Alexander, differing conspicuously in the structure of the male hypopygium.

133. MOLOPHILUS (MOLOPHILUS) NESIOTICUS sp. nov. **Plate 4, fig. 29.**

Belongs to the *gracilis* group and subgroup; general coloration dark plumbeous gray; posterior border of scutellum brownish yellow; antennæ (male) short; halteres yellow; wings weakly tinged with brown, the prearcular and costal fields more yellowed; abdomen dark brown, the hypopygium more brownish yellow; male hypopygium with the mesal lobe of basistyle narrowed into a black spine, the ventral lobe strongly clavate; outer dististyle a sinuous rod, the slightly expanded outer half with abundant erect setæ; both dististyles terminating in a long slender spine.

Male.—Length, about 4 millimeters; wing, 4.5; antenna, about 0.9.

Rostrum and palpi dark brown. Antennæ (male) relatively short, as shown by the measurements, dark brown; flagellar segments passing through oval to subcylindrical, with very long verticilis. Head medium gray, with abundant yellow setæ.

Thoracic dorsum chiefly dark plumbeous gray, the pretergites restrictedly yellow; humeral region of the præscutum obscure yellow; posterior border of scutellum broadly obscure brownish yellow. Pleura brownish black. Halteres yellow, the base of stem somewhat clearer. Legs with the fore coxæ infuscated, the remaining coxæ yellow; trochanters yellow; remainder of

legs brown, the femoral bases broadly paler; tarsi darker brown. Wings with a weak brownish tinge, the prearcular and costal fields more yellowed; veins very pale brown, the macrotrichia darker. Venation: R_2 lying shortly beyond the level of r-m; petiole of cell M_3 nearly three times m-cu; vein 2nd A sinuous, ending just beyond m-cu.

Abdomen dark brown, the hypopygium more brownish yellow. Male hypopygium (Plate 4, fig. 29) with the dorsal lobe, *db*, of basistyle small; mesal lobe, *mb*, appearing as a flattened blade that narrows at apex into a slender straight black spine; ventral lobe, *vb*, strongly clavate, the outer half with a concentration of strong black setæ. Outer dististyle, *d*, a sinuous rod, the stem slender, glabrous, the outer half more expanded, with abundant erect setæ, the apex narrowed into a slender spine; inner dististyle a little longer, the outer half expanded, narrowed into a long slender spine.

Habitat.—Japan (Shikoku).

Holotype, male, Mount Tsurugi, Awa, Otiai, June 5, 1950 (*Issiki-Ito*).

The present fly is entirely distinct from the most similar regional species, including *Molophilus* (*Molophilus*) *efferox* Alexander, *M.* (*M.*) *ferox* Alexander, and *M.* (*M.*) *polycanthus* Alexander. It differs particularly in the structure of the male hypopygium, including the basistyle and both dististyles.

134. MOLOPHILUS (MOLOPHILUS) NOCTICOLOR sp. nov. **Plate 4, fig. 30.**

Belongs to the *gracilis* group and subgroup; general coloration polished black; antennæ short, black; legs black; halteres white; wings strongly tinged with brown, the base yellowed; male hypopygium with the basistyle terminating in three lobes, the mesal one very large, with conspicuous setæ; outer dististyle bearing a strong spine near apex; inner dististyle a sinuous blackened rod with scattered spinulæ on outer half; phallosomic structure very broad, with low lateral shoulders, the surface with setulæ.

Male.—Length, about 4 to 4.2 millimeters; wing 4.5 to 4.8; antenna, about 1 to 1.1.

Female.—Length, about 4.5 to 4.7 millimeters; wing, 4.5 to 5.

Rostrum and palpi black, the former polished. Antennæ black throughout, relatively short; flagellar segments subcylindrical, subequal to or a little shorter than the verticils. Head polished black.

Thoracic notum polished black, the pleura duller. Halteres with stem dirty white, the knob clear white. Legs dark brown

to brownish black, the femoral bases in cases a little paler. Wings strongly tinged with brown, the centers of the cells of posterior half somewhat clearer, prearcular field yellowed; veins stout, brown, darker than the ground. Venation: R_2 in transverse alignment with r-m or virtually so; petiole of cell M_3 more than three times m-cu; vein 2nd A ending about opposite one-fourth the length of the petiole of cell M_3.

Abdomen, including hypopygium, brownish black. Male hypopygium (Plate 4, fig. 30) with the basistyle, *b*, terminating in three lobes, the dorsal one shortest, slender; mesal lobe, *mb*, very large and fleshy, with very conspicuous erect to subretrorse setæ; ventral lobe, *vb*, a long dusky glabrous blade, its apex obtuse. Outer dististyle, *d*, a powerful rod that bears a strong spine near apex. Inner dististyle longer, appearing as a sinuous blackened rod that narrows to an acute point, the base swollen, the outer half with scattered spinulæ. Phallosomic structure, *p*, a very broad plate with low lateral shoulders, the surface with abundant setulæ, those of the outer part longer and erect.

Habitat.—Japan (Shikoku).

Holotype, male, Totidani, near Yanase, altitude 350 meters, May 2, 1951 (*Issiki–Ito*). Allotype, female, Nisigawa, near Yanase, altitude 900 meters, May 3, 1951 (*Issiki–Ito*). Paratopotype, 1 male, pinned with type; paratypes, 1 male, 1 female, with the allotype.

Compared with other polished black species with whitened halteres, such as *Molophilus* (*Molophilus*) *daimio* sp. nov., this fly is told by the coloration of the head, legs and wings and especially by the very different male hypopygium.

135. MOLOPHILUS (MOLOPHILUS) TAKAOENSIS Alexander.

Molophilus takaœnsis ALEXANDER, Philip. Jour. Sci. 51 (1933) 404–405, *pl. 1, fig. 24* (venation), *pl. 4, fig. 53* (♂ hypopygium).

TOSA: Kokusen near Yanase, altitude 500 meters, May 5, 1951 (*Issiki–Ito*).

Formerly known from Mount Takao, Honshu.

ILLUSTRATIONS

[Legend: *a*, Aedeagus; *b*, basistyle; *c*, cercus; *d*, dististyle; *db*, dorsal lobe of basistyle; *dd*, dorsal dististyle; *g*, gonapophysis; *h*, hypovalva; *mb*, mesal lobe of basistyle; *p*, phallosome; *s*, sternite; *t*, tergite; *vb*, ventral lobe of basistyle; *vd*, ventral dististyle.]

Plate 1

Fig. 1. *Tanyptera perangusta* sp. nov.; venation.
2. *Dolichopeza* (*Nesopeza*) *circulans* sp. nov.; venation.
3. *Nephrotoma electripennis* sp. nov.; venation.
4. *Dolichopeza* (*Nesopeza*) *circulans* sp. nov.; male hypopygium.
5. *Nephrotoma daisensis* Alexander; male hypopygium.
6. *Nephrotoma flavonota* (Alexander); male hypopygium.
7. *Tanyptera angustistyla* Alexander; male hypopygium.
8. *Tanyptera perangusta* sp. nov.; male hypopygium.

Plate 2

Fig. 9. *Nephrotoma pullata* (Alexander); male hypopygium.
10. *Nephrotoma virgata* (Coquillett); male hypopygium.
11. *Nephrotoma esakii* Alexander; ovipositor.
12. *Tipula* (*Arctotipula*) *hirticula* sp. nov.; venation.
13. *Tipula* (*Arctotipula*) *hirticula* sp. nov.; male hypopygium.
14. *Tipula* (*Acutipula*) *gemma* sp. nov.; male hypopygium.
15. *Tipula* (*Acutipula*) *bulbifera* sp. nov.; male hypopygium.

Plate 3

Fig. 16. *Limonia* (*Dicranomyia*) *nankaidœnsis* sp. nov.; venation.
17. *Limonia* (*Dicranomyia*) *nankaidœnsis* sp. nov.; male hypopygium.
18. *Limnophila* (*Dicranophragma*) *microspila* sp. nov.; venation.
19. *Limnophila* (*Dicranophragma*) *microspila* sp. nov.; male hypopygium.
20. *Hexatoma* (*Eriocera*) *cerberus* sp. nov.; venation.
21. *Hexatoma* (*Eriocera*) *imperator* sp. nov.; venation.
22. *Lipsothrix leucopeza* sp. nov.; venation.

Plate 4

Fig. 23. *Erioptera* (*Hoplœrioptera*) *shikokuensis* sp. nov., venation.
24. *Erioptera* (*Hoplœrioptera*) *shikokuensis* sp. nov.; male hypopygium.
25. *Erioptera* (*Hoplœrioptera*) *luctuosipes* sp. nov.; venation.
26. *Erioptera* (*Hoplœrioptera*) *luctuosipes* sp. nov.; male hypopygium.
27. *Molophilus* (*Molophilus*) *daimio* sp. nov.; hypopygium.
28. *Molophilus* (*Molophilus*) *iyoanus* sp. nov.; hypopygium.
29. *Molophilus* (*Molophilus*) *nesioticus* sp. nov.; male hypopygium.
30. *Molophilus* (*Molophilus*) *nocticolor* sp. nov.; male hypopygium.

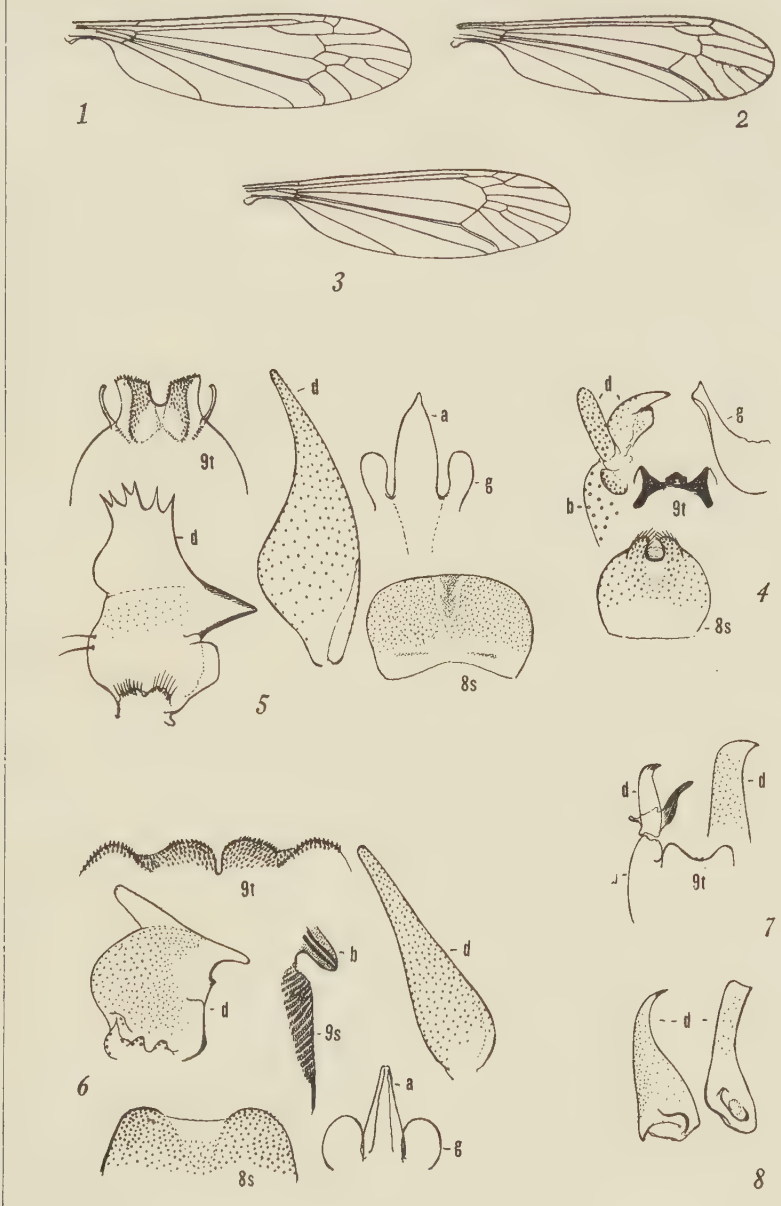
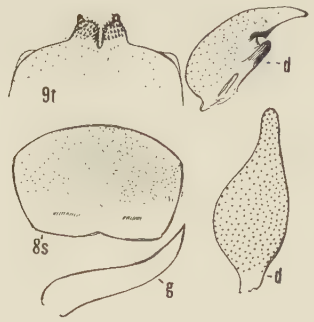


PLATE 1.



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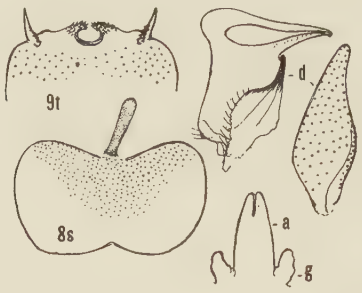

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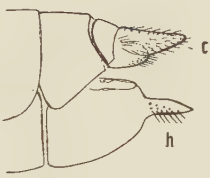

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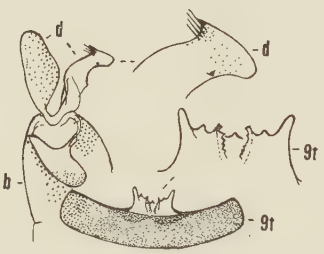

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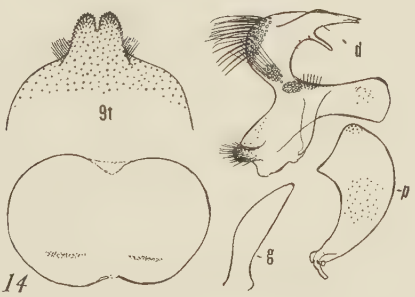

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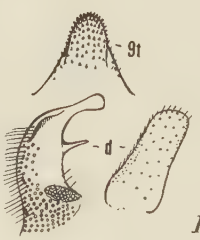

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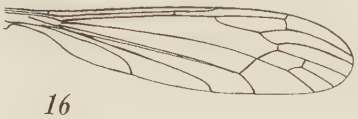
PLATE 2.



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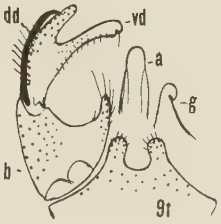

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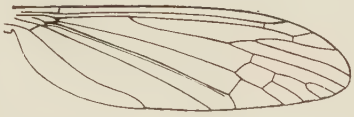

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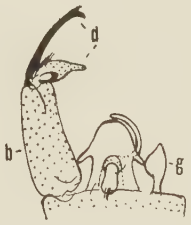

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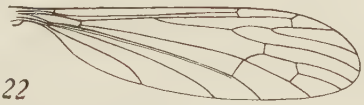

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PLATE 3.

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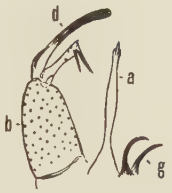

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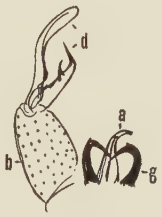

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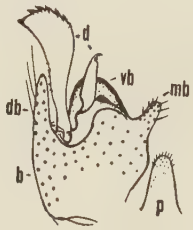

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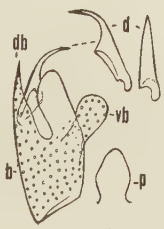

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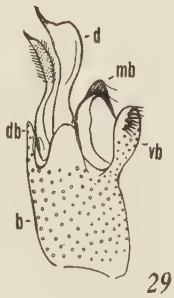

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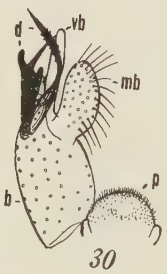

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PLATE 4.

TROPICAL PACIFIC GOBIES WITH VOMERINE TEETH

By Albert W. C. T. Herre
Of the School of Fisheries, University of Washington

As indicated in previous papers, we know very little about the Vomerodontia, the gobies with vomerine teeth. Still less is known about the Eleotridæ with vomerine teeth, though one, *Bostrichthys sinensis* Lac., has been known for 150 years.

In my last paper on gobies with vomerine teeth nine genera and 14 species were recognized. I here present three more genera, each with a single species, so that we have 12 genera and 17 species of gobies with vomerine teeth from the tropical Pacific. No doubt this number will be greatly increased when further collections of gobies from the tropical Indo-Pacific are studied. The new species are from the Marshall Islands, a region whose gobies are little known.

Of the 17 species of vomerine gobies known, 10 are from the Philippines. This large proportion is merely due to the fact that Philippine gobies have been more intensively collected and studied than those of any other region in the tropics. One of the 10 Philippine species is also known from the Pelew Islands and Singapore, and another one likewise occurs at Bikini. One of the vomerine gobies is only known from Samoa, and two are thus far only known from Singapore. It is evident from this distribution that we know little about the number of kinds of gobies with vomerine teeth and have still less knowledge of their true distribution.

The new species are in the collection of the School of Fisheries, University of Washington. Length measurements are of the standard length.

Key to the genera of Indo-Pacific gobies with vomerine teeth

A. Vomerine teeth in longitudinal row on the median line of the palate; 3 fleshy flaps on inner edge of shoulder girdle; opercle with numerous small cycloid scales; a pair of canines behind symphysis of lower jaw ..... *Calamiana*

One species, *Calamiana magnoris* Herre, from Busuanga, Philippines.

AA. Vomerine teeth set transversely; no flaps on shoulder girdle; opercle without many small scales; no post-symphysial canines in lower jaw as far as known.

B. Scales ctenoid, 40 or less.

C. No median predorsal scales.

D. Head naked except for a strip of small cycloid scales above opercle and preopercle; lower jaw with a small posterior canine on each side; dorsal VI–1–8; anal I–7; scales in longitudinal series 24 ..... *Coronogobius*

One species, *Coronogobius striatus* Herre, from Coron, Busuanga, Philippines.

DD. Head and median predorsal strip naked; no canine teeth; an outer row of enlarged curved depressible teeth in each jaw, then a row of minute erect teeth, and an inner row like the outer row of teeth, but smaller, Dorsal VI–I–8 or 9; anal I–8; scales 26 ..... *Thalassogobius*

One species, *Thalassogobius corallinus* Herre, from Bikini.

CC. Median predorsal scales present.

E. Predorsal scales present.

F. Head naked, with many sensory ridges and papillæ; median lateral scales of trunk with vertical rows of papillæ. *Intonsagobius*

One species, *Intonsagobius kuderi* Herre, from Jolo, Philippines, and from Bikini Atoll, Marshall Islands.

FF. Head and nape scaled; no ridges or rows of sensory papillæ on head or trunk ..... *Macrodontogobius*

One species, *Macrodontogobius wilburi* Herre, from Gorror, Pelew Islands.

EE. Predorsal scales more than 6.

G. Predorsal scales 8; lateral scales 28 plus 3 or 4 on caudal base; transverse series 8; two vomerine teeth well separated, and 2 similar but very low teeth behind them ..... *Pallidogobius*

One species, *Pallidogobius rigilius* Herre, from Eniwetok Atoll.

GG. Predorsal scales 9; lateral scales 25 or 26; transverse series 9; vomerine teeth 2, low, distinct, united by their inner edges ..... *Bikinigobius*

One species, *Bikinigobius welanderi* Herre, from Bikini.

GGG. Predorsal scales 14–16; lateral scales 38–40; transverse series 14; vomerine teeth fused into a single chisel-like organ ..... *Mindorogobius*

One species, *Mindorogobius lopezi* Herre, from Hacienda Waterous, Mangarin, Mindoro, Philippines.

BB. Scales ctenoid or cycloid, 40 or more in lateral series, usually 50 or more.

H. Scales ctenoid, or at least ctenoid posteriorly.

I. Scales 40–50, ctenoid or else cycloid anteriorly, the posterior scales enlarged; mouth nearly vertical, chin prominent; no conspicuous lines of papillæ on cheeks ..... *Mangarinus*

One species, *Mangarinus waterousi* Herre, from Mangarin, Mindoro, Philippines.

II. Scales 60–65, all ctenoid or only ctenoid posteriorly; mouth moderately oblique; many lines of sensory papillæ on head ..... *Mars*

Three species are known: *Mars strigilliceps*, Jordan and scale, from Samoa; *Mars cæruleo-maculatue* Herre, from Jolo, Sulu Islands, the Pelew Islands, and Singapore; and *Mars heydeni* Herre, from Bais, Negros Oriental Province, Philippines.

HH. Scales all cycloid, 60 or more.

J. Lower jaw projecting, maxillary extending back on preopercle, scales about 60 ..... *Myersina*

One species, *Myersina macrostoma* Herre, from Culion, Philippines.

JJ. Jaws equal, maxillary not extended back on preopercle; scales 70–85; upper lip lined with dense papillate fringe; body naked before a line from dorsal origin to ventral base ..... *Smilogobius*

Four species known; *Smilogobius inexplicatus* Herre and *S. obliquus* Herre, from Sitankai, Sulu Province, Philippines; and *Smilogobius cinctus* Herre and *S. singapurensis* Herre, both from Singapore.

THALASSOGOBIUS Herre, new genus

Two rather large incisor-like teeth set transversely on the vomer, but more or less concealed by a velum. Dorsal VI-I-8 or 9; anual I–8; scales large, ctenoid, deciduous, 24 to 30 in longitudinal series, 8 to 10 in transverse series, the head and a median strip from dorsal to eyes naked; preventral area and pectoral base with scales smaller than elsewhere and apparently naked, as the scales have fallen off.

Body laterally compressed with delicate fins, the ventrals easily torn, their frenum very fragile. The eyes are high up and very close together. The chin is moderately prominent, the mouth little inclined, with 2 or 3 rows of teeth in each jaw; the tip of the tongue is rounded and free. The gill openings do not extend forward; isthmus moderately broad. Pectoral without free silky rays.

Type of the genus *Thalassogobius corallinus* Herre, new species.

THALASSOGOBIUS CORRALLINUS Herre, new species.

Dorsal VI–I–8 or 9; anal I–8; scales in longitudinal series 26, plus 1 or 2 smaller ones on the caudal base; 8 scales in transverse series; predorsal scales none.

Body wedge-shaped, the dorsal profile moderately arched, the ventral outline very slightly curved, the trunk compressed, the pointed head a little broader than its depth. The type,

a female 36 mm long, has the depth 4.5, and head 3.13 times in length; the large eyes are very high up, dorsolateral in position, their inner margins touching, 3.28 in the head; the convex snout is a trifle shorter than an eye diameter. The mouth is little inclined, moderate in size, the posterior angle of the maxillary barely reaching to a vertical from the front margin of the eye. The teeth are in 3 rows in each jaw, an outer row of recurved depressible teeth and an inner row of slightly smaller recurved depressible teeth, with a row of much smaller erect sharp pointed teeth between.

The dorsal and anal spines and rays are all slender and elongate, the first dorsal spine and longest anal ray each 6 times, the longest second dorsal ray 5⅛ times in the length. The pectoral extends to above the base of the third anal ray and equals the caudal, 3.27 times in the length; the ventral extends to the anal, 4 in the length. The caudal peduncle is long and slender, its least depth 2.5 times in its own length.

A male paratype, 34 mm long, presents no differences of importance but the dorsal and anal fins are higher, and their posterior rays extend noticeably nearer the caudal base when depressed, but still fall much short of it.

The color in alcohol is pale tan, with a tan spot on the caudal base and a short transverse bar of tan on the middle of the caudal peduncle; a series of small tan spots along the dorsal bases and one before the dorsal. A conspicuous circular black spot (ocellated?) midway on the membrane between the first and second dorsal spines. There are indications of 2 dusky or tan cross bars on each dorsal, the fins otherwise all pale.

The two specimens were taken at Arji Island, Bikini Atoll.

PALLIDOGOBIUS Herre, new genus

Vomer with two well separated incisor-like teeth, with round-pointed tips; behind these are two similar but very low teeth. The teeth in the jaws are all small, those of the outer row larger, in 3 rows anteriorly in the upper jaw, apparently but one row posteriorly; lower jaw with 3 or 4 rows anteriorly, 2 rows posteriorly; a small, curved canine on each side of the lower jaw.

Dorsal VI–I–8 to 10; anal I–8 to 10; scales large, smooth, feebly ctenoid, 26 to 30 in lateral series, with several more on the caudal base; predorsal scales 6 to 10; transverse series

of scales 8; cheeks and opercles naked; pectoral base and preventral area scaled. Cheeks with 3 longitudinal rows of sensory papillæ.

The form is wedge-shaped, the trunk laterally compressed, the head broader than the trunk; the blunt steeply descending snout overhanging the inferior mouth; the maxillary extends beneath the middle of the eye. Vertical fins low, the round-pointed caudal longer than the head; ventrals well developed with a strong frenum; the gill openings are a little wider than the pectoral base, the isthmus broad.

Type *Pallidogobius rigilius* Herre, new species.

Pallidus, pale in allusion to the pale coloration of the fish.

PALLIDOGOBIUS RIGILIUS Herre, new species.

Dorsal VI–I–9; anal I–8; scales in a longitudinal series 28 plus 3 or 4 on the caudal base; in transverse series 8; predorsal scales 8.

The form is as given in the generic diagnosis, the head 3.75, the depth 5.45, the caudal 3 times in the length. The eye is dorso-lateral, in the anterior half of the head, a little shorter than the snout, a trifle more than 4 times in the head, the snout a trifle less than 4. The lower jaw is thin, weak, inferior, the angle of the mouth beneath the front margin of the eye, the angle of the maxillary beneath the middle of the eye. The eyes are very close together, the width of the interorbital 4.5 or 5 times in the eye.

The first dorsal is low, the tips of the spines filiform, reaching the second dorsal when depressed, the second and third spines 1.6 times in the head or 6 times in the length; the second dorsal and anal are low, increased in length posteriorly, the last ray of each reaching the caudal base when depressed and seven-eighths of the length of the head, or about 4.29 times in the length. The round-pointed pectoral is longer than the head, 3.33 times in the length; the ventral extends almost to the anal origin, its length approximately equal to that of the head. The genital papilla is long and pointed, equal to the eye.

The color in alcohol is pale and whitish tan, with traces of five broad dusky dorsal cross-bands; the fins are colorless, with vestiges of 2 rows of dusky spots on the dorsals. The membrane between the anterior rays of the anal is dusky bluish, with traces of the same color along the free margin of the fin.

Here described from the type and only specimen, a male 60 mm long, taken at Rigili Island, Eniwetok Atoll, Marshall Islands.

BIKINIGOBIUS Herre, new genus

There are two broad but rather low transverse and widely separated teeth on the vomer. There is an outer row of relatively large and widely spaced curved teeth in each jaw, with a row of very fine teeth behind them. The free tip of the broad tongue is truncate.

Dorsal VI–I–8 to 10; anal I–8 to 10; 24 to 30 large ctenoid scales in a longitudinal, 8 to 10 in a transverse row, and 8 to 10 predorsal; Head naked, the nape scaled. Pectoral base and preventral area with scales a little smaller than those of the sides of the body, and apparently cycloid.

The body is rather plump, the dorsal profile slightly arched, the ventral profile nearly horizontal. The head is rather small, the dorso-lateral eyes large and in the anterior half of the head; the snout is short and overhangs the mouth. The vertical fins are low, the caudal rounded, the other fins moderate; the ventral has a well developed frenum. The caudal peduncle is long and broad, the dorsal and anal not reaching the caudal base when depressed. The gill openings are no wider than the pectoral base, the isthmus broad.

The type of the genus is *Bikinigobius welanderi* Herre, new species. Named from the atoll Bikini, where this fish was discovered.

BIKINIGOBIUS WELANDERI Herre, new species

Dorsal VI–I–10; anal I–8 or 9; scales in lateral series 25 or 26, and 9 in transverse series; 9 predorsal scales.

The plump elongate body is little elevated, its breadth approximately equal to its depth, which is 4.8 to 5 times, the head 5.4 to 5.5, the broad round-pointed caudal 3.25 to 3.35 times in length.

The rather large eye is high up, 4 times in the head and a little less than the convex, broadly rounded overhanging snout, which is 3.3 to 3.7 times in the head. The mouth is inferior, horizontal, the angle of the mouth beneath the anterior margin of the eye. The teeth are as given in the generic diagnosis. The first dorsal spines are slender, with filiform tips, not or barely reaching the second dorsal when depressed, the second or third

spine longest, 6 or 6.5 times in length; the second dorsal and anal are highest posteriorly, the penultinate ray about 5 times in the length. The pectoral is 3.66 to 3.75, the ventral 4 to 4.3 times in the length, both fins reaching to the anal origin in the male but falling short of it in the female. The least depth of the caudal peduncle is about 1.25 times in its own length. There are 3 longitudinal rows of sensory papillæ on the cheek. The male genital papilla is elongate, slender, and pointed; that of the female is shorter, thick and plump with notched tip.

The color in alcohol is pale yellowish tan, with several rows of obscure darker spots and dashes over the back and along the sides; these undoubtedly are vestiges of 7 double transverse bands in like; a few vestigial dusky spots on the head; the fins are all pale, without marks, except the first dorsal which shows traces of 2 dusky cross bands.

The type, a female 57 mm long, and paratype, a male 55 mm long, were taken at Bikini Island, Bikini Atoll. The fins of the male are a little longer in proportion than those of the female.

Named for Dr. Arthur D. Welander, ichthyologist of the School of Fisheries, University of Washington, in recognition of his work on the fishes of Bikini.

Key to the species of Mars

A. Body sprinkled with small pearl blue spots, especially on posterior half; dorsal VI–I–10; anal I–9; scales 60; olive brown with 7 darker cross bands over and down sides ..... *M. cæruleo-maculatus*

AA. No blue or pearl blue spots on body.

B. Dorsal VI–I–10; anal I–9; scales 65; olive brown with 4 narrow grayish cross bands over back; 6 sharply defined irregular cross bands on lower part of head ..... *M. strigilliceps*

BB. Dorsal VI–I–12; anal I–12; scales 65; pale olive brown with 9 darker cross bands over back and down sides; a low median ridge from first dorsal to interorbital..... *M. haydeni*

Key to the species of Smilogobius

A. Scales about 70 in lateral series. Brownish gray above, nearly white beneath; 8 broad blackish cross bands running diagonally downward and forward ..... *S. inexplicatus*

AA. Scales in lateral series 75 or more.

B. Scales 75; dusky brown with 3 vertical broad blackish cross bands and 11 or 12 vertical white lines between dorsal and under side; first dorsal with 6 rows of white spots; ventrals dark brown sprinkled with circular black spots; head with small circular dark brown spots which are blue-black ocelli in life ..... *C. cinctus*

BB. Scales 75–85.

C. 75–80; ground color creamy with 7 or 8 bluish plum colored cross bands over back and extending diagonally forward to under side; nape and sides of head sprinkled with dark blue ocelli, which may extend back to caudal peduncle; male with blue ocelli on dorsal and anal and ventrals dark blue. *S. singapurensis*

CC. Scales 80–85; brownish gray above, nearly white beneath; 8 broad blackish cross bands running diagonally downward and forward; fins all colorless ..... *S. obliquus*

THE TROPICAL PACIFIC ELEOTRIDÆ WITH VOMERINE TEETH WITH DESCRIPTIONS OF TWO NEW GENERA AND TWO NEW SPECIES FROM THE MARSHALL ISLANDS

By Albert W. C. T. Herre
Of the School of Fisheries, University of Washington

The study of Indo-Pacific gobies, beginning with those of Samoa in 1902, has brought to light many notable facts concerning their distribution and habits. It has also made known many rare and little known species as well as many unique and singular forms.

Among the more remarkable gobies are those distinguished by the presence of large vomerine teeth. There are now 12 genera known, containing 17 species, distributed from Singapore to Samoa and the Marshall Islands. The above are all true gobies of the family Gobiidæ.

Only one true eleotrid with vomerine teeth has been known in the past. It was described by Lacépède in 1802. It is now my pleasure to present two new genera and two new species of Eleotridæ with vomerine teeth, collected in the Marshall Islands by Dr. Arthur D. Welander, of the University of Washington School of Fisheries. The specimens described are in the collection of the School of Fisheries. All lengths are the standard length.

Key to the tropcial Pacific Eleotridæ with vomerine teeth

A. A semi-oval spot of teeth on the vomer ..... *Bostrichthys*

AA. A pair of incisor teeth which may be fused or form a ridge, set transversely on vomer.

B. A large incisor across vomer, the two elements fused; scales cycloid, minute, 150–160 in lateral series; dorsal VI–I–24 to 30; anal I–24 to 30 ..... *Gracileotris*

BB. Two vomerine teeth fused to form a low transverse ridge, more or less concealed; scales ctenoid, 50–75 in lateral series; dorsal VI–I–10 to 16; anal I–10 to 12 ..... *Zebreleotris*

GRACILEOTRIS Herre, new genus

This genus is strongly distinguished from Ptereleotris, to which it is related, by the presence of a large incisor-like tooth across the vomer, the two elements being fused into one.

Dorsal VI–I–24 to 30, last spine of first dorsal remote from others and attached by a broad membrane extending posteriorly; anal I–24 to 30; scales minute, cycloid, not imbricate, about 150 to 160 in lateral series, sides of head and predorsal area naked; pectoral bases and preventral area scaled.

Body is elongate, low, laterally compressed; eyes lateral, in the anterior half of the head, moderately large; mouth strongly oblique, with prominent chin. Upper jaw has an outer row of enlarged fixed teeth followed by 2 rows of much smaller teeth; lower jaw has 1 or 2 rows of small teeth across the front with a row of much larger teeth, some of them caniniform, behind and along the sides. Fins are all low, caudal a little longer than head and more or less lunate, its upper and lower rays elongate; dorsal and anal rays are all simple. The gill openings are little wider than pectoral base, isthmus broad.

Type of the genus *Gracileotris bockensis* Herre, new species. *Gracileotris,* from *gracilis,* slender, and *Eleotris,* a genus of fishes.

GRACILEOTRIS BOCKENSIS Herre, new species

Dorsal VI–I–24 to 28; anal I–24 to 27; scales 150 to 160 in longitudinal and 40 to 46 in a transverse series.

Body is elongate, low, slender and laterally compressed, dorsal profile very slightly curved and nearly horizontal, abdominal profile slightly arcuate, depth 6 to 6.25 times, head 4.66 to 4.9, caudal 3.8 to 4, pectoral 6.25 to 7, ventrals 5.3 to 5.4 times in length. Eye is high up, lateral, 3.75 to 4.1 the short snout less than the eye, 4 to 4.2 times in the head; the nearly flat interorbital is about equal to an eye diameter; mouth is nearly vertical, its posterior angle about half way between tip of snout and eye, but maxillary extends beyond, reaching to below the front margin of eye or further. Teeth are as given for the genus.

Fourth dorsal spine is longest, with filiform tip, at least in males, extending to the second dorsal, 5.6 times in the length, last spine reaching to origin of second anal ray. Second dorsal and anal are very much alike, their anterior third highest; longest second dorsal rays 8 to 8.6, longest anal rays 8.6 to 9 times the length; posterior dorsal and anal rays may reach caudal base when depressed; pectorals are broad and round-pointed; narrow, elongate ventrals extend about halfway to anal origin; caudal peduncle is broad and short, its least depth equal to its own length.

The color in alcohol is uniform pale yellowish, becoming bluish white on the belly; iris is silvery bluish, pupil dusky; fins are all colorless, except for a deep reddish black diagonal cross-bar, inclined downward and forward on lower two-thirds of basal part of pectoral; this band is bordered by a white bar before and behind.

This trim little eleotrid must be a very handsome and active fish in life.

Here described from the type, a male, 73 mm long, and 6 paratypes 59 to 70 mm long, from Bock Island, on the outer reef of Rongeril Atoll.

ZEBRELEOTRIS Herre, new genus

This eleotrid genus is distinguished as follows: a pair of vomerine teeth fused into a low transverse ridge on the palate, more or less covered by a velum; one or two pairs of canines anteriorly in the upper jaw, and a double row of fine teeth; 2 pairs of anterolateral canines in the lower jaw, with a narrow band of fine teeth in 2(?) rows. Dorsal VI–I–10 to 14; anal I–10 to 12; ventral I–4; 60 to 75 rows of ctenoid scales in a longitudinal and 20 to 26 rows in a transverse series; predorsal scales extend half way to eyes; cycloid scales on pectoral base and preventral area; head naked.

The head and low slender body are laterally compressed, the fins all moderate, the vertical fins rather low; caudal a little shorter than the head, its tip rounded; mouth terminal, oblique, rather large, extending to or nearly to a vertical from the pupil; lower jaw scarcely projecting; eyes high up; dorso-lateral, the interorbital very narrow or the eyes in contact along their inner margins. The gill openings are rather large, extending forward to below the middle of the preopercle, the isthmus narrow. The dorsal and anal rays are undivided or only sligthly so at the very tips.

Type of the genus *Zebreleotris fasciata* Herre, new species. *Zebreleotris,* a striped *Eleotris,* from *Zebra,* a zebra, hence striped, and *Eleotris,* a genus of fishes.

ZEBRELEOTRIS FASCIATA Herre, new species

Dorsal VI–I–13; anal I–12; ventral I–4; scales in a longitudinal series about 70, plus 4 to 6 on the caudal base and 22 to 24 rows in a transverse series; predorsal scales about 20, extending half way from dorsal base to eyes.

Depth of low slender laterally compressed body is 5.66 (5.8 in a juvenile specimen), head 3.56 to 3.7, caudal 3.5 to 3.9 times

in the length. Pectoral is rather elongate, reaching to or slightly beyond anal origin, 3.7 to 3.9 times in the length; ventrals are long and narrow, their outer margin with fringed rays as in *Eviota*, 4.1 to 4.25 in the length and not quite reaching anal.

Eye is 3.3 times in the head, interorbital space very narrow, 7 times in the eye, or zero and eyes touching. Short rounded snout is 1.7 in the eye or 5.7 in the head. Terminal oblique mouth is large, its posterior angle under the anterior third eye, maxillary extending beyond the middle of eye, 2.38 in the head. Dorsals and anal are of moderate height, first dorsal reaching the origin of the second when depressed; third dorsal spine is longest, 5.66 times in the length; first member of the second dorsal is 7.28 in the length; last ray of second dorsal and anal are longest and equal in length, 6.37 in the length; neither reaches caudal base when depressed. Least depth of caudal peduncle is twice in its own length.

The color in alcohol is whitish tan with 5 broad dark brownish transverse bands encircling the body; the first, from nape to throat, and the second, from under the first dorsal to behind the ventral origin, are inclined forward and downward; the others are more nearly vertical, two below the second dorsal and the fifth on the caudal peduncle; there is a faint vertical bar on the caudal base; the four lowermost caudal rays are blackish or may have only a longitudinal blackish blotch at their base; a dusky spot on the preopercle, just over the hind end of the maxillary; vestiges of a few pale spots or ocelli behind the eyes; a dark longitudinal band along the middle of the anal, with a much darker stripe along its upper and lower margins, the fins otherwise pale with a few colored specks on the dorsals. In life the markings were probably dark purplish reddish or brown, with a pearly lustre over all.

The type is a female 51 mm long; the paratype, 41 mm long, is an undeveloped female and does not have all the markings or proportions of the other. Both were taken at Bikini Island, Bikini Atoll. Banded.

A NEW SPECIES OF GNATHOLEPIS WITH A KEY TO THE TROPICAL PACIFIC SPECIES

By Albert W. C. T. Herre
Of the School of Fisheries, University of Washington

The genus *Gnatholepis*, created by Bleeker, is a very natural one. It is separated from all the other small slender gobies without silky rays on the pectoral by having the cheeks entirely covered and the opercles partly or entirely covered with large ctenoid scales. In some species only the lips, eyes, and lower jaw are naked; everywhere else the head is entirely covered with scales.

Dorsal VI–I–7 to 11; anal I–7 to 11; scales 24 to 32 in longitudinal series. Tongue is usually notched. Teeth are in 2 to 4 rows in each jaw and canines may be present in one or both jaws, or may be absent.

Gnatholepis includes coral reef fishes ranging all over the tropical Indo-Pacific. It is also found in the West Indies.

GNATHOLEPIS SCAPULOSTIGMA Herre, new species

Dorsal VI–I–11; anal I–10; scales in a longitudinal series 30, plus 2 on the caudal base; 9 scales in a transverse series and 8 predorsal. Cheeks and opercles are covered with comparatively large deciduous scales, of which very few are left. Tongue is slightly notched.

Body is rather elongate, laterally compressed, with blunt head, dorsal profile little elevated, depth 4.7, head 3.47, caudal 3.3 times in the length. Eye is large, in the anterior half of head, dorsolateral in position, 3.75 times in the head; narrow interorbital is 3.5 times in the eye. The bluntly rounded convex and slightly overhanging snout is 3 times in the head. Mouth is small, oblique, maxillary barely extending to a vertical from the anterior margin of the eye. Teeth are in two rows, those of the outer row a little enlarged, with a pair of lateral canines in the lower jaw. No rows of sensory papillæ on cheek. First dorsal spines are elongate with thread-like tips, first one 3 times in the head, third and fourth longest, 2.6 in the head and extending to the base of the second dorsal when depressed; last dorsal and anal ray are elongate, last dorsal ray 2.1 in the head, last anal ray slightly shorter, both reaching the caudal when depressed.

Pectoral extends to a vertical from the second dorsal origin. Large ventral has a well developed frenum and extends upon the anal. Pointed caudal is longer than the head.

The color in alcohol is yellowish gray, the under side of the head nearly white; the fish was apparently golden yellow in life. There are six broad vertical reddish brown bands along the side, which divide into two above and extend to dorsal base; a broad spot at caudal base; a large dark brown spot above pectoral base, with a pale bar extending into it at the middle of its upper margin; a violet brown stripe from the eye diagonally downward behind the mouth. There are 6 faint dusky lines from the head to the caudal base; apparently they are the blackish margins of three dusky longitudinal bands which have largely disappeared.

The fins are all colorless.

Here described from the type and only specimen, a male 36.5 mm long, collected by Dr. Arthur D. Welander at Engebi Island, Eniwetok Atoll, Marshall Islands.

This fish belongs near *Gnatholepis deltoides* but is strongly differentiated from that and related species by the presence of the large dark blotch on the shoulder. The name *scapulo-stigma*, refers to the shoulder spot.

Key to the species of Gnatholepis from the Philippines and adjacent regions

A. *Exyrias:* Two prominent longitudinal grooves on cheek, dividing its scales into three groups ..... *G. puntangoides*

AA. *Gnatholepis:* Cheek not as above.

B. No line from eye across cheek.

C. A. prominent groove below upper row of scales on cheek; no canines ..... *G. calliurus*

CC. No prominent groove on cheek.

D. A large black or dark purplish brown spot above the pectoral base.

E. Spot covers 6–8 scales, each with a pearly spot on it; dorsal VI–I–10; anal I–9; scales 28; predorsal scales 16 ..... *G. koumansi*

EE. Spot smaller, without pearly spots in it; dorsal VI–I–11; anal I–10; predorsal scales 8 ..... *G. scapulo-stigma*

DD. No large dark spot above pectoral base.

F. A large elongate black spot on the first dorsal from the third to beyond the sixth spine; dorsal VI–1–7; anal I–7; scales 32 ..... *G. mingi*

FF. No large black spot on first dorsal, second dorsal and anal with 9 or more rays.

G. Dorsal V–I–10; anal I–9.

H. No canine teeth; eye 4 in head; 3 or 4 series of sensory papillæ below eye; a round brown spot on caudal base and white points on the rays; ventral and margin of anal white ..... *G. baliurus*

HH. No rows of sensory papillæ below eye; males with a very small lateral canine in lower jaw; females without canines; eye 3 in head; 5 large blackish spots on side, alternating with white spots, with rows of white spots above and below; a black spot on the pectoral base; a row of 7 dusky spots along the dorsal profile from dorsal origin to caudal base ..... *G. hendersoni*

GG. Dorsal VI–I–10; anal I–10 or I–11.

I. Tongue strongly notched; anal I–10; scales 28, predorsal scales 14; no canines, teeth of outer row enlarged, curved, exposed ..... *G. turneri*

II. Tongue slightly emarginate; scales 30, predorsal 12; a pair of stout canines in lower jaw; 2 or 3 pairs of canines in upper jaw ..... *G. volcanus*

BB. A vertical or diagonal line from eye across cheek and behind mouth.

J. Line not intersected.

K. A large brown spot on cheek with 2 diverging lines continued downward, forming the Greek letter delta; anal I–11, bluish; caudal with black spots on its lower half..... *G. deltoides*

KK. Black line from eye to throat not divided.

L. Dorsal VI–I–11; anal I–9; small pearly or bluish white spots on sides of head and lower part of body; anal with one or 2 rows of black spots; no spots or ocelli on caudal. *G. corlettei*

LL. Dorsal VI–I–11; anal I–10, with one or two rows of black ocelli, alternating with large yellow spots which turn white in alcohol; caudal with 5 to 8 rows of ocelli .... *G. davaoensis*

JJ. Line from eye to throat intersected by one or two short transverse lines.

M. Scales 25–27; predorsal scales 10; dorsal VI–I–11 or 12; anal I–11. Brillant emerald spots over sides in life, with clusters of gold spots along middle of sides of head and trunk; anal with 2 rows of violet ocelli alternating with vertically elongate yellow spots; caudal with 5 or 6 cross rows of violet ocelli. In alcohol the golden spots change to pearl or bluish, with black margin, anal ocelli become black, yellow spots turn to white. No papillæ or grooves on cheeks. One or 2 pairs of canines in upper jaw..... *G. gemmeus*

MM. Scales 30; predorsal scales 8; dorsal VI–I–11; anal I–11; no emerald or gold spots in life; no pearl spots on preserved specimens; no anterior canines in upper jaw; First dorsal crossed by 5 or 6 lines; second dorsal pectoral and caudal with 6 or more cross rows of brown dots ..... *G. knighti*

DISTRIBUTION OF THE TROPICAL PACIFIC SPECIES OF GNATHOLEPIS

1. GNATHOLEPIS PUNTANGOIDES (Bleeker)

This is the longest and bulkiest of the group in the Indo-Pacific, and is often seen in the markets. It is called *burok* and another name is *kamumbon*. It reaches a length of about 125 mm. It is found on all Philippine coasts, and ranges from the Andaman Islands through the East Indies to the Caroline and Solomon Islands, and tropical Australia.

2. GNATHOLEPIS CALLIURUS Jordan and Seale

This little fish is only known from the Philippines, Borneo, and Singapore. It is common from Manila Bay to the shores of British North Borneo. It scarcely becomes more than 80 mm long.

3. GNATHOLEPIS KOUMANSI Herre

Only known from the Straits of Malakka. Reaches a length of 65 mm.

4. GNATHOLEPIS SCAPULO-STIGMA Herre

Only known from Eniwetok Atoll, Marshall Islands. The type is 36.5 mm long.

5. GNATHOLEPIS MINGI Herre

Only known from the type, 42 mm long taken at Pulau Ubin, a small island near Singapore.

6. GNATHOLEPSIS BALIURUS (Cuv. and Val.)

This little goby is widely distributed in the East Indies but has only been recorded at Cebu in the Philippines. It reaches a length of about 75 mm long.

7. GNATHOLEPIS HENDERSONI Herre

A handsome little goby only known from Singapore harbor. It probably does not exceed 50 mm.

8. GNATHOLEPIS TURNERI Roxas and Ablan

The type and only specimen was taken by beam trawl in the Gulf of Lingayen, Pangasinan Province, Luzon. Its length was 91 mm.

9. GNATHOLEPIS VOLCANUS Herre

This rather large goby is only known from Lake Bombon, Batangas Province. It reaches a length of 100 mm or more. It is caught with hook and line, and used for food.

10. GNATHOLEPIS DELTOIDES (Seale)

Originally described from Guam, this small fish is found throughout the central and southern Philippines and ranges southeast to Fiji and Samoa. It does not seem to exceed 50 mm.

11. GNATHOLEPIS CORLETTEI Herre

Very close to *G. deltoides,* of which it may be only a juvenile variant. Only known from Bushman Bay, Malekula Island, New Hebrides. The largest specimen is scarcely 25 mm long.

12. GNATHOLEPIS DAVAOENSIS Seale

This small goby is only known from the Philippines. It occurs throughout the Visayas, Mindanao, and Sulu Province. It does not seem to be more than 50 mm long.

13. GNATHOLEPIS GEMMEUS Herre

This gorgeously colored and beautiful fish is common on the coral reefs of Negros Oriental and southward throughout the Philippines. It has also been collected in the New Hebrides. Apparently it does not reach a length of 50 mm.

14. GNATHOLEPIS KNIGHTI Jordan and Evermann

This Hawaiian species is abundant there and also occurs on the shores of Luzon and Polillo.

NEW SPECIES OF CAPNIDÆ (PLECOPTERA) FROM JAPAN

By Mrs. Mitsuko Kohno
Of Zaimokucho, Wakamatsu City, Fukushima Prefecture, Japan

THREE TEXT FIGURES

Having found in my collections of Capniidæ some new species in genera not previously reported from Japan I am presenting the following notes and descriptions.

I am particularly indebted to Dr. J. F. Hanson who kindly sent me copies of his papers and has assisted me in various respects in my study of Japanese Plecoptera. I am also indebted to Dr. H. H. Ross who kindly took the trouble to send me the late Dr. T. H. Frison's papers on American Plecoptera.

Genus NEMOCAPNIA Banks

Nemocapnia Banks, Psyche **45** (1938) 73, 74; Frison, Ill. Nat. Hist. Survey Bull. **22** (1942) 262–264; Hanson, Amer. Midl. Nat. **35** (1946) 223–225, 236.

Nemocapnia was erected by Banks in 1938. Frison in 1942 and Hanson in 1946 discussed this genus in further detail. It included a single species, *carolina* Banks.

Banks enumerated the following characters for *Nemocapnia* which, except for (4) below, coincide with those of my new species. They are: (1) R_1 straight at origin of Rs, (2) anal area of hind wing arching not more than three-fourths of the way to wing tip, (3) no crossvein beyond end of subcosta, (4) cerci short (7–8 segmented), (5) slender species.

In his comparative studies of the Capniidæ Hanson mentions several additional generic features on the basis of the lone species of *Nemocapnia* then known. Of the nine characters that he listed, only with the first and eighth does the new species described herein differ. (1) Presterna of all thoracic segments merge with the basisternum of the segment concerned (in *N. japonica* sp. nov., the presternum on only the prothoracic segment merges with the basisternum). (2) Mesothoracic furcasternum narrowly transverse and not divided by a suture along the mid-ventral line. (3) Mesothoracic spinasternum extremely narrow. (4) Mesothoracic postfurcasternal plate

large and united to the spinasternum and furcasternum. (5) Meso– and metathoracic epimeron partially divided into anepimeron and katepimeron by a grove. (6) In fore wing R_1 straight at base, 1st A slightly curved just beyond cu-a. (7) No costal crossvein beyond Sc. (8) Cerci 6 to 7 segmented (in *N. japonica* they are 12 segmented). (9) subgenital plate of male distinctly demarked but not separated along lateral margins from remainder of 9th sternite by membrane.

In addition to the above-mentioned characters, other fundamental similarities of this new species and *Nemocapnia carolina* occur in: (1) male genital plan, (2) female subgenital plate, (3) lengths of the five segmented of the maxillary palpi, (4) the structure of the labium and the length ratio of the segments of the labial palpi, (5) wing venation (*N. japonica* with one crossvein between C and Sc in both fore and hind wings).

Accordingly, I place this new species in the genus *Nemocapnia*, although it differs slightly from the American *Nemocapnia*, in the three points already mentioned, as well as in the following respects: (1) shape of mandible, (2) shape of mesothoracic postfurcasternal plate, (3) mesothoracic spinasternum elongated and reaching to the front margin of metathoracic presternum.

NEMOCAPNIA JAPONICA sp. nov.

Male.—Body blackish-brown, average size for this genus; antennæ composed of more than 26 segments; head large and round; compound eyes brownish; a pair of black subtriangular marks situated in front of the median ocellus; face-mark large, prolonged to the hind ocelli. Prothorax rectangular, the ratio of the length to breadth nearly 5:7: marginal grooves, middle furrow, and embossing black. Meso- and metathoraces uniformly blackish brown. Abdomen blackish brown, furnished with similarly colored hairs; supra-anal process long, yellow, sclerotized, prolonged upwards and backwards. Cerci composed of about 12 segments, the first segments twice as long as the second and longer than the third; remaining segments increasing successively in length toward the end, except for the 12th segment, which is seven-tenths as long as the 11th. Legs blackish-brown. Wings hyaline, veins sepia brown; region between C and R_1 at apex of hind wing semihyaline; anal field of hind wing narrow. Labrum very delicate; mandibles small but well developed; maxillary palpi very stout, with length ratio of segments nearly 1:2:4:3:4; labium small, second palpal segment longest, other segments relatively very short.

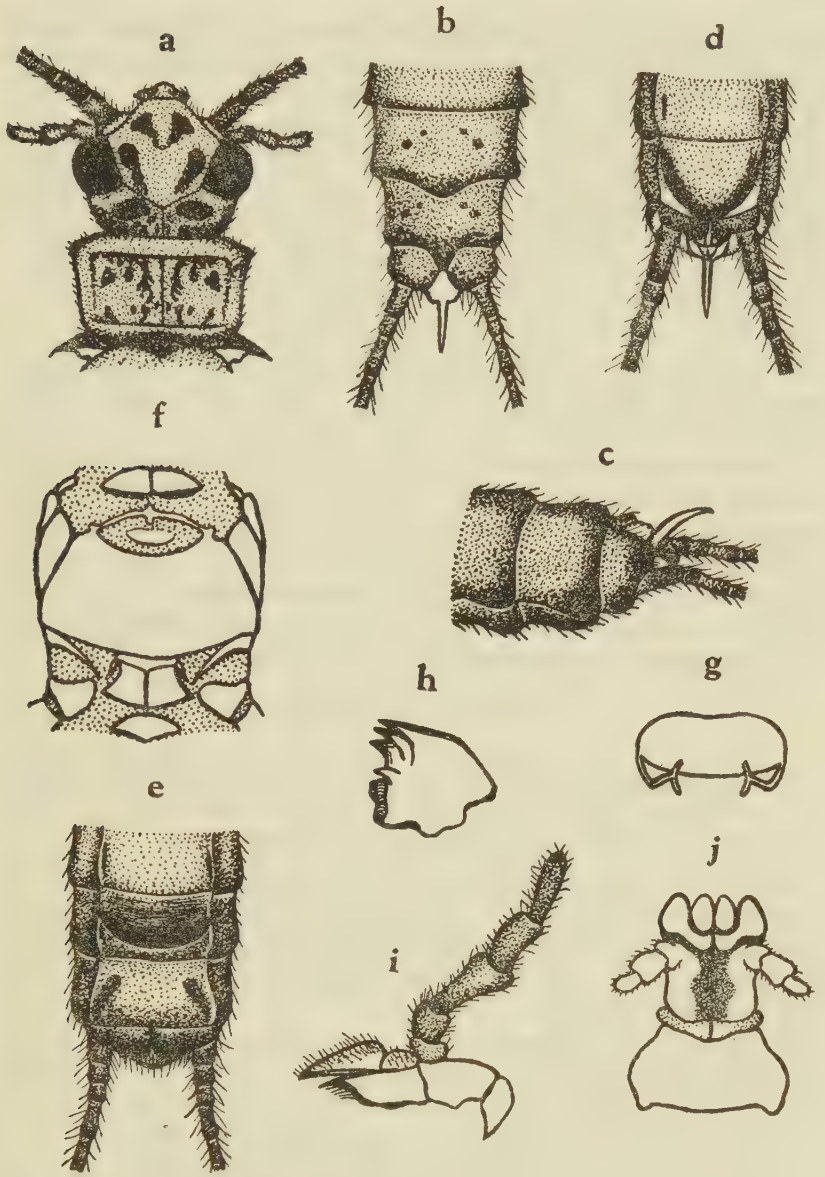

FIG. 1. *Nemocapnia Japonica* sp. nov.
a. Head and prothorax. b. Male genitalia, dorsal view. c. Male genitalia, lateral view. d. Male genitalia, ventral view. e. Female genitalia, ventral view. f. Mesosternum. g. Labrum. h. Mandible. i. Maxilla. j. Labium.

Ventral plates of this species differ from *N. carolina* as follows: cervical sclerities of *N. japonica* narrower and longer transversely; meso- and metathoracic presterna narrower trans-

versely; metathoracic furcasternal arms longer; mesothoracic spinasternum extending to metathoracic presternum; prothoracic postfurcasternal plates narrower.

Female.—Similar in most morphological features to the male. A broad flesh-brown membranous median stripe extends longitudinally across abdominal tergites 2 through 7. In ventral view blackish-brown, with stripe across sternites 1 through 7. Both sides flesh-brown; lateral plates and remaining segments blackish-brown. Subgenital plate short, with round hind margin.

FIG. 2. Wings of *Nemocapnia japonica* sp. nov.

Length.—5.2 millimeters in male, 6 in female; antennæ, 4.2 in male, 4 in female; cerci, 3.2 in male, 4 in female; fore wing, 6 in male, 7 in female; hind wing, 5.2 in male, 6 in female.

Holotype, male, Chusetsu Bridge, Gifu City, Japan, April 19, 1951. Allotopotype, female. Paratopotypes, two females, April 11, 1941; female, April 17, 1941; male, three females, April 19, 1941; two females, April 21, 1941.

Genus ISOCAPNIA Banks

Isocapnia BANKS, Psyche 45 (1938) 73, 74 (*Arsapnia grandis* BANKS designated as genotype); FRISON, Pan-Pacific Ent. 18 (1942) 68–69; HANSON, Brooklyn Ent. Soc. Bull. 38 (1943) 155–163; HANSON, Amer. Midl. Nat. 35 (1946) 193–249.

Isocapnia was erected as a new genus of Capniidæ in 1938 by Banks on the basis of *Arsapnia grandis* Banks. At present, *Isocapnia* contains four American species; namely, *I. abbreviata* Frison, *I. crinita* (Needham and Claassen), *I. grandis* (Banks), and *I. integra* Hanson.

As a result of investigations of Japanese capniids, a new species was found which I am placing in *Isocapnia*. It differs only in some minor details from the genus as described by Hanson on the basis of American species. *I. japonica* is in conformity with the nine characteristics listed below that he considered to be of generic value, except for items 1, 8, and 9: (1) R_1 and 1st A of fore wing straight at base; (2) paraglossæ partially demarked from the labiostipites; (3) postalar bridge present on both pterothoracic segments; (4) mesoepimeron with a transverse dark band; (5) mesothoracic furcasternum poorly demarked from the postfurcasternal plates with which it is united; (6) metathoracic furcasternum united with and poorly demarked from the first abdominal sternite;

(7) prothoracic presternum broadly fused with the basisternum; (8) basal region of ninth abdominal sternite separate from the subgenital plate and bearing a broadly rounded median, ventral appendage (in *I. japonica* this appendage is not so large); (9) female with a narrow, median longitudinal, membranous stripe extending across abdominal tergites two through eight (in *I. japonica* this stripe is not so narrow, taking from one-fourth to one-third of the width of the abdominal segments).

In addition to the foregoing, other fundamental similarities exist between American species of *Isocapnia* and this new species in: (1) general plan of male terminalia, (2) division of the 10th tergite of the male into two rounded portions which unite posteromesally with the bulbous base of the supra-anal process, (3) shape of the female subgenital plate, (4) length ratio of the segments of labial palpi.

The new species described here differs from Hanson's detailed account of the genus in only three minor details: (1) middle portion of the prothoracic spinasternum produced into a long narrow projection backwards; (2) presternum of mesothorax detached from mesothoracic basisternum; (3) middorsal abdominal membranous stripe not narrow but from one-fourth to one-third the width of the abdomen.

ISOCAPNIA JAPONICA sp. nov.

Male.—Dimorphic: (1) a dwarfish form with short wings, and (2) a normal sized form with normal wings. Body of normal form not fully sclerotized; blackish-brown but with some gray color. Head rather large, round; face-mark black; three pairs of black marks at frontal diagonal position of the middle ocellus; three ocelli forming a right triangle; compound eyes comparatively small; a cluster of rather long hairs at the lateral margin behind compound eye. Antennæ composed of over 32 segments furnished with long brown hairs; basal fourth of antenna yellowish except for the large blackish-brown first segment; darker toward the blackish-brown tip. Meso-, metathorax, and abdomen blackish-brown. Supra-anal process amber in color, very slender, extending upwards and backwards. Cerci composed of about 24 segments; pale brownish except for yellowish bases on basal half of cercus; each segment armed with long pale brown hairs. Wings as shown in Fig. 5; semihyaline, with veins brown. Femora of legs dotted with dark brown irregular spots on distal half. Mouthparts: mandible very small but well developed; maxillary palpi dark gray,

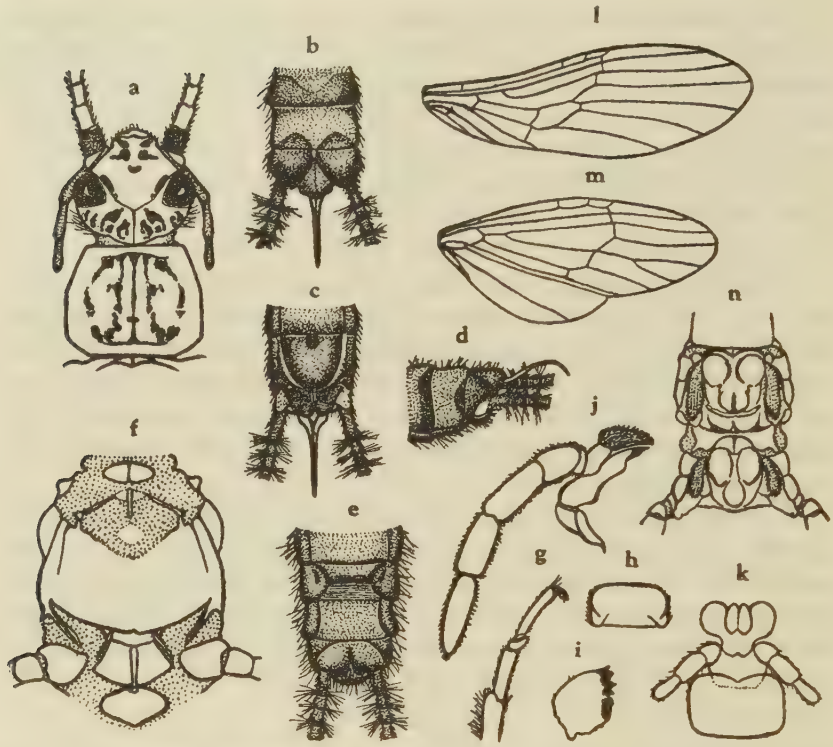

FIG. 3. *Isocapnia japonica* sp. nov.
a. Head and prothorax. b. Male genitalia, dorsal view. c. Male genitalia, ventral view. d. Male genitalia, lateral view. e. Female genitalia, ventral view. f. Mesosternum. g. Left fore leg. h. Labrum. i. Mandible. j. Maxilla. k. Labium. l. Fore wing. m. Hind wing. n. Short wing (male).

huge and very stout, their length ratios being 1:4:8:7:8; labial palpi very stout; paraglossæ very large. Mesothoracic furcasternal arms not united with the postfurcasternal plate in this species. Nor is the prothoracic furcasternum produced posteriorly at two points to unite with the postfurcasternum in this species.

Dwarfish form is similar in most morphological features to normal male. It differs in the following respects. Wings very small; hind wing generally smaller than fore wing; wings armed densely with fine hairs on all sides and seeming to contain many grains inside. Antennæ composed of not over 35 segments. Cerci composed of about 16 very long segments.

Female.—Similar in most morphological features to normal male. Abdomen with broad (one-fourth to one-third the ab-

dominal width) pale yellow membranous median stripe extending longitudinally across tergites 1 through 7. Eighth abdominal sternite not produced posteriorly into a subgenital plate but membranous in its median posterior half.

Length.—6.6 millimeters in normal male, 4 in dwarfish male, 7.5 in female; antennæ, 6 in normal male, 3 in dwarfish male, 5 in female; cerci, 5.8 in normal male, 4.2 in dwarfish male, 7 in female; fore wing, 7.6 in normal male, 8 in female; hind wing, 6.5 in normal male, 6.2 in female.

Holotype, male, Takada Bridge, Japan, April 15, 1942. Allotopotype, female, April 19, 1948. Paratopotypes, twenty-one males (n.w.), two males (d.w.), sixteen females, April 15, 1942; male (n.w.), female, April 16, 1942 (M. Nagamine): five males (d.w.), three females, April 19, 1948: male (n.w.) April 29, 1948 (Higashiyama). All specimens are preserved in my collection.

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BOOKS

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Fundamentals of Semicicro Quantitative Analysis. By Erwin B. Kelsey and Harold G. Dietrich. Revised Edition. New York, Macmillan Company, 1951. 328 p. illus. Price, $4.00.

In the preface the authors state that the procedures of analysis employed in this textbook are for the most part the same as those used in standard macro work. Semimicro procedures offer several advantages such as the reduction of materials and reagents to a minimum thus saving time and labor, and the effectiveness of many tests is increased and a good estimate of the relative amount of the ion present is obtained.

This book satisfies a long-felt problem of assembling widely scattered literature in the field of semimicro analysis. It presents the basic principles of solution theory and chemical equilibria with their application to analytical separation and identification of the common ions. The presentation of the solution theory offers a simpler approach to protolytic equilibrium, and the treatment of hydrolysis is analogous to that of a weak acid or a weak base.

This revised edition has retained the scope and level of the original one; the theoretical part skillfully coordinated with the laboratory practice employed in analytical procedures. There are two sections: The first deals with the fundamental theory underlying the systematic methods of qualitative analysis; and the second deals with the analytical procedures. The theoretical part endeavors to give reasons for the analytical procedures and results in terms of solution theory especially that in relation to ionization, protolytic equilibria, solubility product, complex-ions, and oxidation-reduction. The practical side teaches the careful manipulation, close observation and logical interpretation of the results.

There is a more rigorous approach to anion analysis, and the number of anions to be studied remains relatively small so as to show the mutual interferences between anions and how to avoid them. The analytical procedures are so written that each of the three anion groups may be studied without consideration of the other groups if desired. The identification of each ion can be done in the initial presence of any of the others. The separate Iron and Nickel groups as of the previous edition has

been combined into a single group designated as "The Basic Hydrogen Sulfide Group."

Descriptive materials are included with the presentation of the theoretical aspects of the subject matter. A short section discussing the applications of principles to the precipitation and in the systematic separation of each ion of a group follows the outline of every analytical group introduced. Each chapter concludes with a set of questions and problems to serve as guide for study and review of the subject matter.—S.S.T.

Principles of Chemistry. By Joel H. Hildebrand and Ricard E. Powell. Sixth Edition. New York, Macmillan Company, 1952. 444 p. illus. Price $4.50.

This is a good book. It treats of the principles of chemistry in a very illuminating way. The explanations and expositions of facts are accompanied by illustrations, hence, students can not miss to grasp the idea the authors want to convey.

This book is abreast of the latest trend on principles of chemistry. There are new innovations which are found needed in other texts of the same kind. The electron-Donor-Acceptor System is well taken up and illustrated. The structure, crystal systems, the arrangement of atoms or molecules as shown by X-ray defraction in an inorganic compound is well explained and demonstrated. At the end of each chapter are problems based on the principles discussed in every chapter. In Appendix I of this book are interesting problems which will test the ability of students at the close of the school year.

This book is an ideal class room text or reference, especially for students who are majoring in inorganic chemistry.—R.R.O.

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